SOIL SURVEY OF Spink COUNTY

SOUTH DAKOTA

BULLETIN 439
JUNE 1954

AGRONOMY DEPARTMENT AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE COLLEGE, BROOKINGS
IN COOPERATION WITH THE SOIL CONSERVATION SERVICE, U.S.D.A.

Cover Picture

Aerial view of Tulare, in southwest Spink County, and the landscape to the east. Photograph courtesy of Ernest Polak and Ray Herold of Tulare.

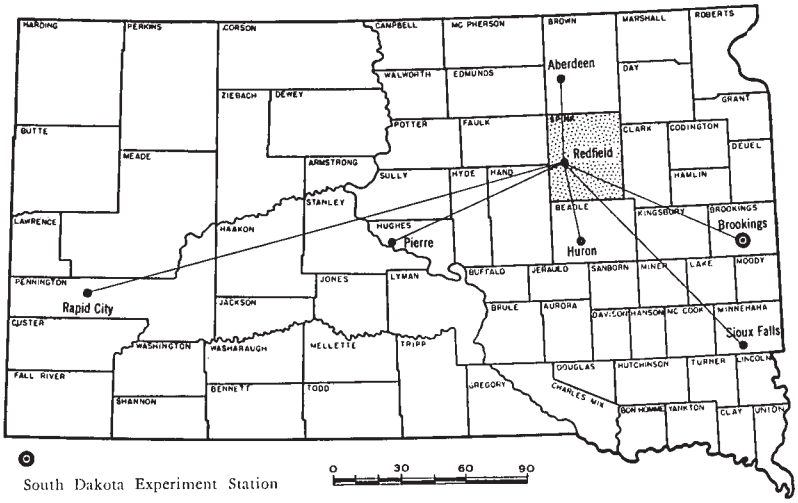

Fig. 1. Location of Spink County in South Dakota

PREFACE

How to Use the Spink County Soil Survey Map and Report

This soil survey report with its accompanying map presents information about the soils, crops, and agriculture of Spink County. It also deals briefly with such related topics as topography and cultural features. This soil survey is designed to meet the needs of a wide variety of readers. The following paragraphs indicate the sections of interest to persons concerned with specific tracts of land, to those concerned with the county as a whole, and to students and teachers of soil science and related agricultural subjects.

Readers Interested Chiefly in Specific Tracts of Land. This group includes farmers, agricultural technicians interested in planning operations in communities or on individual farms, prospective purchasers and tenants, farm loan agencies, land appraisers, and real estate agents. The following steps are suggested for these readers: (1) locate on the soil map the farm with which concerned. This can be done from the legal description of the property as townships and ranges are shown along the margin of the map and the sections are numbered. (2) Identify the soils of the farm by use of the legend booklet in the map folder. (3) Locate in the report the page where each type of soil is described. (4) Refer to the section on "Use, Management, and Productivity of Soils" for specific information about the soils including their irrigation potential.

The yield predictions along with the other data in the section on "Use and Management" can be used by farmers to examine their present field layout and cropping system with the view of developing a better farm plan. Several alternate plans with budgets can be calculated, any of which will maintain and improve soils.

Large scale aerial photographs showing fences, field boundaries, location of all buildings, and additional soils information, are available at the offices of both the county agent and the soil conservation district at Redfield. These large scale maps may be preferred by those readers seeking information on all basic land features that affect soil use and management.

Readers Interested in the Area as a Whole. This group includes those concerned with general land use planning, such as the placement and development of highways, power lines, industries, community cooperatives, resettlement projects, and areas for wildlife management, tree planting and recreation. The following sections are intended for this group of readers: (1) Natural Geography of Spink County in which the location and size, physiography, relief, drainage, climate, water supply, and native vegetation are discussed; (2) Cultural Geography of Spink County in which the organization and population, transportation, and trading centers are discussed; (3) Agriculture of Spink County in which a brief history

and the present status of the agriculture are described; and (4) Use, Management, and Productivity of the Soils of Spink County in which the soils are grouped into classes for which yield predictions are made for alternative systems of management.

Students and Teachers of Soil Science and Allied Subjects. This group will probably be most interested in the section on "Soils of Spink County." For those not already familiar with the classification and mapping of soils, these subjects are discussed under "Purpose and Methods of Soil Surveys." Teachers of other subjects will find the sections on "Natural Geography of Spink County, Cultural Geography of Spink County, Agriculture of Spink County, and the Use , Management, and Productivity of the Soils of Spink County," of value in determining the relations between their subjects and the soils of the area.

Summary

Spink County covers an area of 936,840 acres in east central South Dakota. The topography is nearly level to undulating with only a few rolling areas. Elevation above sea level ranges from about 1,300 to 1,400 feet. Drainage is to the south with the principal stream being the James River.

The original vegetation was a mixture of short, mid, and tall grasses. In general, the undulating uplands had mixtures of short and mid grasses, while the sandy plain and the alluvial areas were occupied by tall grass associations.

The materials from which the soils have developed include glacial deposits of sand, silt, clay, and gravel; and alluvium (stream deposits). The soils are classified according to their internal and external characteristics, with emphasis on the features that influence crop production. The principal classification units are series, type, phase, and complex. Each of these units is described in detail with regard to composition, distribution, and agricultural use.

The productivity of a particular soil depends on a large number of factors which include climate, soil characteristics, and management. Of these management is the only factor that can be controlled. A system of management consists of several practices which the farmer selects and combines into a system best suited to his farm. Since the soil pattern differs for each farm, it influences the choice of management practices. Crop rotations, maintenance of organic matter in the soil, tillage, the use of commercial fertilizers, and erosion control practices can be used. The soils of the county have been divided into 19 groups on the basis of the factors which affect the use and and management of the soil. The principal problems of management for each of the 19 groups of soils are discussed, and estimated yields of wheat, corn, oats, barley, alfalfa, and wild hay are given for each soil. The irrigation potential of each soil series, type, phase, and complex is also given.

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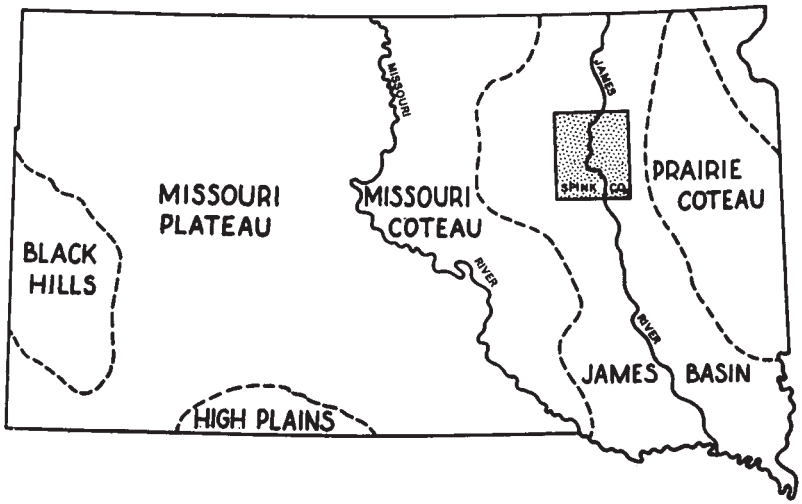

Fig. 2. Physiography of South Dakota

SOIL SURVEY OF *Spink* COUNTY, SOUTH DAKOTA

F. C. WESTIN, G. J. BUNTLEY, W. C. MOLDENHAUER, F. E. SHUBECK[1]

NATURAL GEOGRAPHY OF SPINK COUNTY

THE IMPORTANT features of the landscape are described briefly in this section. Physiography, relief, stream drainage, soil parent materials, climate, and native vegetation all affect soil formation and the use of soils for agriculture. Knowledge of these features will aid in understanding the subsequent discussion of soils.

Location and Extent

Spink County lies in the east central part of South Dakota. The air mileage from Redfield, the county seat, to Pierre, the state capital, and to other towns and cities in South Dakota is shown in Fig. 1. (see inside cover). The County is 42 miles long and 36 miles wide, with a total area of 936,840 acres.

Physiography, Relief, and Stream Drainage

Spink County lies in the north central portion of the James River Basin in east central South Dakota (Fig. 2). This area is a gently undulating drift plain of low relief. For convenience of discussion Spink County may be divided into five general soil areas (Fig. 3). Soil Area A, the bed of Glacial Lake Dakota, dominates the central part of the county and is rimmed by undulating areas on the west, south, and east. The surface of the Lake Bed is remarkably level being broken only by the shallow, flat-bottomed trenches of the stream channels. The elevation of the Lake Bed is about 1,300 feet and this elevation varies less than 15 feet over its entire extent except where the streams have excavated their shallow valleys (8).[2]

The evidence that Glacial Lake Dakota existed late in the glacial period is well established (2, 4, 9). The principal evidence is the presence of old beach lines which are especially noticeable near the city of Aberdeen in Brown County. The materials of the Lake Bed which are mainly silt and clay are thought to have been brought to the area by

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Soils were surveyed by F. C. Westin, G. J. Buntley, W. C. Moldenhauer, G. B. Lee, J. M. Beardsley, F. E. Shubeck, J. U. Anderson, D. I. Ketterink, D. DeKramer, J. W. Krueger, K. Torve, and B. Roberts of the South Daktoa Agricultural Experiment Station; A. J. Klingelhoets jointly of South Dakota Agricultural Experiment Station and Soil Conservation Service; and V. W. Moxon, F. Matanzo, M. M. Striker, E. R. Lumb, B. Kidman, H. Stout, J. Harwood, C. Byerly, E. Francis, R. Parker and C. A. Mogen of the Soil Conservation Service, USDA.

Soils were correlated by C. A. Mogen, Senior Soil Correlator, USDA Division of Soil Survey.

Appreciation is extended to L. F. Puhr, L. O. Fine, and B. L. Brage, Agronomy Department, South Dakota State College for assistance in preparing the section on "Use, Management, and Productivity of Soils."

[2]Numbers in parenthesis refer to Literature Cited.

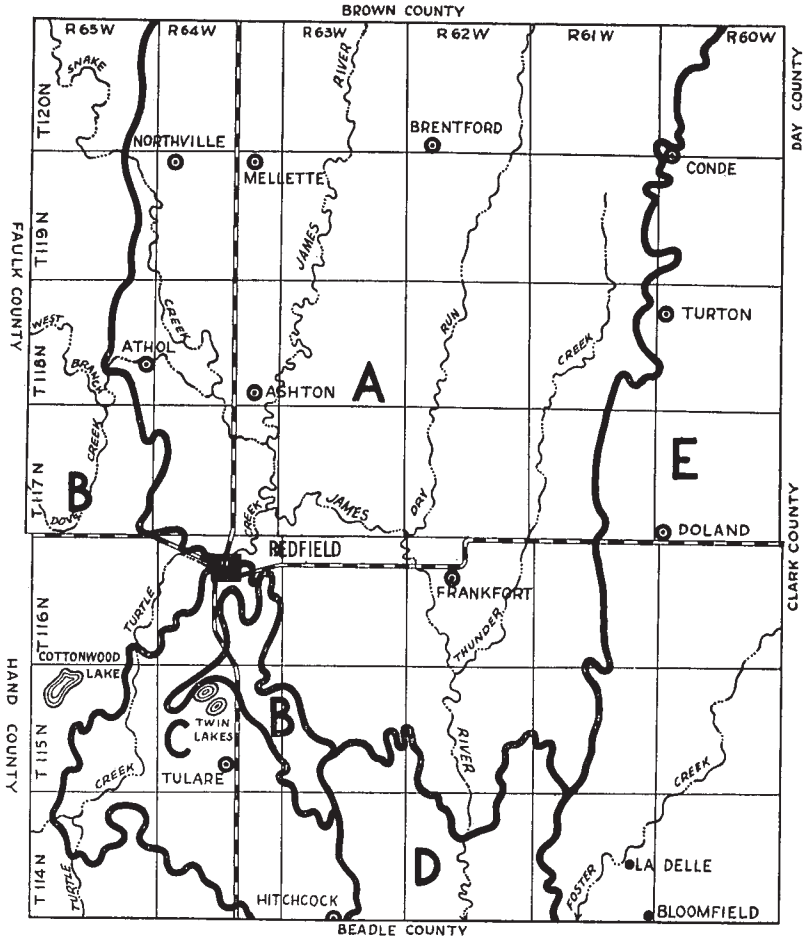


Fig. 3. General soil areas of Spink County

A. Nearly level, medium to fine-textured soils of the Lake Bed. (Chiefly Aberdeen, Beotia, and Harmony)

B. Undulating to rolling, medium- textured soils of the upland. (Chiefly Houdek and Bonilla)

C. Nearly level to hummocky sandy soils. (Chiefly Hecla and Wessington)

D. Nearly level, moderately fine-textured soils of the upland. (Chiefly Beadle soils with nonsaline parent materials)

E. Undulating to rolling, moderately fine-textured soils of the upland. (Chiefly Houdek, Beadle, and Cavour)

streams flowing from a melting glacier and there deposited in standing water.

Soil Area B (Fig. 3) consists chiefly of an undulating to rolling plain of low to moderate relief with many short complex slopes and only a few long simple slopes. The local

relief[3] varies from 2 to 5 feet on undulating topography and 5 to 20 feet on rolling topography. Many small closed depressions and scattered sloughs and ponds dot the landscape and collect most of the surface runoff from the higher lying land. Several hilly areas occur in this general region—Bald Mountain north of Cottonwood Lake, and the Redfield Hills which start just southeast of Redfield and extend southwest to Twin Lakes.

Soil Area C (Fig. 3) is a nearly level to hummocky sandy plain of low relief. Much of this area has drifted during the dry years, and in the areas affected, the topography is hummocky and consists of many closely spaced, low, round-topped dunes. Scattered depressions, some large and poorly drained, and some merely small wet dips occur in the gently undulating plain. Sparsely scattered throughout the area are low hills, which rise 10 to 20 feet above the gently undulating plain. The materials in Soil Area C are mainly outwash of coarse sand and fine gravel size.

Soil Area D (Fig. 3) is a nearly level to gently undulating plain of low local relief having comparatively few closed depressions. Many glacial boulders occur on the soil surface and in the upper part of the soil profile. Scattered on this nearly level plain are low rises, some oblong in shape and oriented north and south. The boulders and the flatness of the topography suggest that this area in Spink County is an erosional plain formed during the draining of Glacial Lake Dakota.

Soil Area E is an undulating plain dissected with streams which originate on the Prairie Coteau to the east (see Fig. 2). Although many streams are present, they do not finger back and drain all the upland. There are many small depressions and some scattered sloughs present. Several noticeable landscape features occur in this area. The Doland Hills form a north-south trending ridge about 12 miles long paralleling the Lake Bed (Glacial Lake Dakota) in the vicinity of Doland. It consists of a hilly area of complex slopes. A few miles west of Turton is a low ridge of well-sorted sand and gravel trending parallel to the Lake Bed and occurring just where Area E and the Lake Bed meet. This appears to be a beach line of Gacial Lake Dakota. Just south of Turton and within the city limits of Conde there are low gravelly ridges which trend east and west.

The principal stream draining Spink County is the James River. It flows south the entire length of the county in a rather narrow trough 30 to 70 feet below the glacial plain. The elevation drop from where the river enters Spink County on the north to where it leaves it in the south is 26 feet (6). This gives the river a drop of about 6 inches per mile as the crow flies and a drop of considerably less than this when the meanderings of the stream are considered. The remaining streams of the county are shown on Fig. 3 and on the soils map.

[3]Local as used here refers to differences in elevation within a quarter section.

Soil Parent Materials

The nature of the soils which occur in an area is due to the combined influences of several factors, one of which is the kind of material from which the soils have developed. Four important kinds of parent materials have left their marks on Spink County soils—lacustrine materials, glacial till, outwash, and alluvium. Each is described briefly in this section. A fifth kind of parent material, which is of limited occurrence, is the loess which occurs in patchy areas in Soil Area E (Fig. 3) northeast of Doland.

Lacustrine deposits occur in the Lake Dakota Plain, Soil Area A (Fig. 3), and cover roughly half of Spink County. Lacustrine deposits are silty and clayey sediments laid down in standing water. The thickness of the lacustrine sediments varies from about 3 to 35 feet. The James River has exposed the underlying Pierre shale at several places, and in other areas glacial till has been encountered within 5 feet of the surface. This indicates that the topography of the materials underlying the lacustrine sediments is quite irregular.

The lacustrine sediments are light yellowish-brown and usually distinctly laminated. The lamination consists of thin alternate layers of silt and clay. The sediments are highly calcareous and usually moderately saline.

Glacial till, laid down by ice, consists of mixtures of clay, silt, sand, gravel, and boulders in variable proportions. Not all sediments are present in every deposit. Glacial till is the main soil parent material in Soil Areas B, D, and E. In Soil Area B (the West Till Plain) the till is of a loam texture and contains about equal amounts of sand, silt, and clay. In Soil Area D (the South Till Plain) the till is a clay loam and contains proportionately higher amounts of sand and clay and smaller amounts of silt. In Soil Area E (the East Till Plain) the till is also principally a clay loam.

In addition to varying in texture, the glacial tills of Spink County vary in other respects. The till of the West Till Plain is light yellowish-brown, calcareous, and usually moderately saline. The till of the South Till Plain is olive brown, sploched with soft white lime nodules, and is nonsaline. The till of the East Till Plain is predominantly olive colored, splotched with lime, and moderately saline. Shale chips occur locally in the till of the East Till Plain.

Outwash, laid down by waters flowing from a glacier, consists of sorted sand and gravel deposits. In Soil Area C the outwash occurs mostly on a gently undulating plain. The thickness of the predominantly sandy deposits in this area varies from a few to many feet. The outwash itself is leached of lime and salts. The presence of dunes and buried soils in certain localities in this area tell of a history of soil blowing.

Alluvium, which is not shown as a separate area in Fig. 3, consists of sediments that have been moved and laid down by water. They are the stream bottoms and terraces

and their occurrence is in long thin strips along the streams. Although sorted some by moving water they usually have a rather narrow range in texture and include principally mixtures of silt, clay, and sand. When the sediments have accumulated at the foot of the slope where they originated they are referred to as colluvial-alluvial sediments.

Loess consists of uniform silty sediments laid down by the wind. In Spink County the loess occurs as a mantle overlying parts of the East Till Plain northeast of Doland. The loess in this area is about 3 feet thick. The bed of the Glacial Lake Dakota was apparently the source of the loess and it probably blew from this area soon after the retreat of the ice before the Lake Bed was stabilized by vegetation.

Salinity of Soil Parent Materials in Spink County. One objective of the Spink County soil survey is to indicate the irrigation potential of the soils in this area. This is done in the section of the report titled "Use, Management, and Productivity of the Soils of Spink County" and also in the descriptions of the individual types and phases.

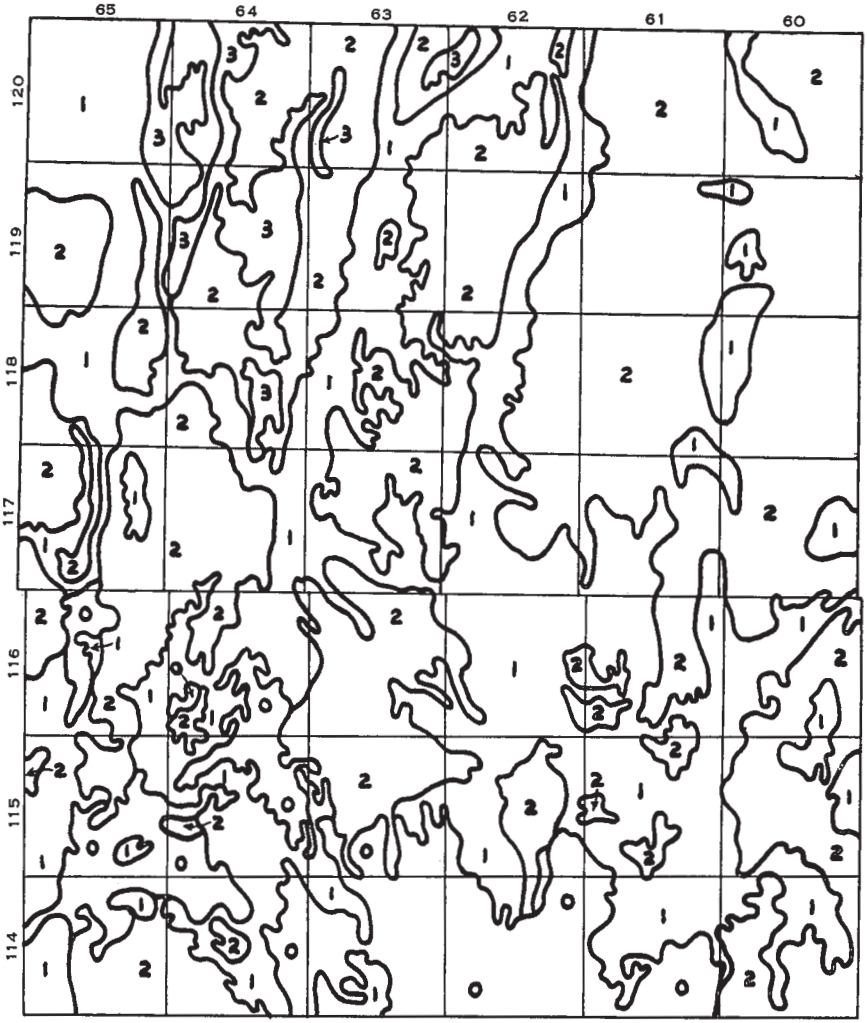
Even though some of the soils now are good irrigation prospects, if gravity irrigation is to be used extensively in the James River Basin, the salinity of the soil parent materials will become a factor in the successful use of the soils for this purpose. The key is drainage. Drainage through the soils and their parent materials must be adequate to remove harmful concentrations of salts brought in with the irrigation water and to prevent uptake to the soil profile of salts that might be present in the parent materials. Thus the presence or absence of salts in the soil parent material is a factor in assessing the potential irrigability of the soils.

All soils contain soluble salts; in fact nutrients which nourish growing plants usually occur in the form of salts in the soil. Saltiness becomes serious when the concentration increases to a degree toxic or harmful to plants. Although it varies somewhat with the kind of plant, salinity is harmful when it gets over a concentration of 0.15 percent (about 1 part salt to 666 parts of dry soil). Plant growth hangs in a delicate balance, and if soils are salted or become salted they cease to be good media for the growth of plants.

The form of the salts when they occur in soil parent materials is the same as the form of salts in soils. The dominant salts are common ones and include sodium chloride (same as table salt), sodium sulfate, magnesium chloride, magnesium sulfate, calcium chloride, and calcium sulfate. Calcium carbonate is present in large amounts in the parent materials of all Spink County soils but is quite insoluble and thus is unimportant as a toxic salt in soils.

The salinity of the soil parent materials in Spink County is shown in Fig. 4. It should be emphasized that this map is not completely accurate because the salinity of parent materials may change over a distance of a few feet. However, it does give

Fig. 4. Salinity of soil parent materials in Spink County, South Dakota based on analyses of 1712 soil profiles taken to a depth of 5 feet*



0 None to slight. Less than 0.15 percent soluble salt.
1 Slight. 0.16 to 0.35 percent soluble salt.
2 Moderate. 0.36 to 0.65 percent soluble salt.
3 High. Greater than 0.65 percent soluble salt.

*Based on analyses of 730 soil profiles by the South Dakota State College Agricultural Experiment Station, 950 profiles by the Reclamation Bureau, USDI, and 32 profiles by the Federal Division of Soil Survey, USDA.

a general picture of salinity in the parent materials of the soils.

Climate

The climate of Spink County is characterized by extremes and irregularities throughout the four seasons of the year. Spring is moist, cool, and windy; summer is sunny, hot, and usually fairly dry; autumn is dry, cool, and sunny; and winters are cold and relatively long.

If the climate of Spink County were uniform it would be easy to select adapted crops and management practices. The history of Spink County has been one where a succession of good years has encouraged the use of crops and practices suited to more humid regions. Then crop and livestock losses follow when unfavorable weather comes.

Climatic Conditions Important in Spink County Agriculture. In this soil survey report the crop rotations and other management practices used are designed for the soils of Spink County taking into consideration the climate of the county. In the yield predictions shown for the soils, note has been taken of the climate along with other factors which influence productivity. This has been done by giving the yield predictions for the soils (under defined systems of management) for three sets of growing conditions: (1) Unfavorable, (2) Favorable, and (3) Very Favorable. Favorable growing conditions for small grains are not the same conditions which favor row crops or pastures. Considering climate alone, the conditions which favor small grain are cool, rainy conditions with low humidity during spring and early summer. For row crops the most favorable climatic conditions are warm, moist, humid days and nights with adequate summer rainfall and a long growing season. Unfavorable, favorable, and very favorable growing conditions are discussed in the section of this report titled "Use, Management, and Productivity of the Soils of Spink County."

In addition to the factors of temperature and precipitation, there are other climatic factors which are important in Spink County agriculture. These are the excess of evaporation over rainfall, much wind, some hail, and a great deal of sunshine. These climatic factors along with temperatures and precipitation, are discussed in the following sections.

Temperature. Spink County, which is in the continental interior, has extremes of temperature because it is far from any large bodies of water which tend to keep coastal areas from wide temperature fluctuation. Moreover, this region is alternately influenced by air masses from northern regions and from the gulf. For these reasons seasonal, and even daily, fluctuations of temperature are great.

The average length of the frost-free season for four reporting stations in Spink County is as follows: Ashton—142 days; La Delle—130 days; Mellette—134 days; Redfield—140 days. This is not necessarily the length of the growing season, as frequently exhaustion of soil moisture

may be the determining factor in measuring the length of the growing season.

The average monthly temperatures for Spink County and vicinity are shown in Table 1.

Precipitation. The autumn, winter, and spring precipitation in Spink County is generally what is termed "frontal" precipitation. This kind of precipitation, some of which comes as snow, falls at a slow rate and over relatively long periods with individual storms covering most of the county.

Summer precipitation is mostly rain of the thunderstorm type. These rains usually cover only a part of the county, although they may affect the whole county on any given day. The rain comes as short, hard showers which may be accompanied by strong winds and hail. Much of this type of rainfall is lost by runoff on the undulating to rolling, medium and fine-textured soils, especially if soil tilth is poor.

In Spink County the agricultural significance of rainfall depends principally on its seasonal distribution, its variation in amount from year to year, and the rate of evaporation. In this county the heaviest rainfall comes in the period April through August. Table 2 shows the average precipitation by months for Spink County and the surrounding area.

Excess of Evaporation Over Rainfall. In Spink County the potential evaporation and transpiration (loss of water by growing plants) are greater than the rainfall. Actually evaporation is, of course, less than rainfall because part of the water is absorbed and held by the soil and part of it is lost by runoff. Sandy soils absorb nearly all of the rain which falls on them while finer textured soils like silty clay loams and clay loams have rather high runoff if they occur on undulating, sloping, or rolling terrain. Soil management practices aimed at improving the tilth of these finer textured soils increase absorption of rainfall and thus increase crop yields.

Climates are sometimes classified by taking into account both rainfall and temperature (7). This type of climatic classification attempts to arrive at an effective rainfall for an area. Based on this classification the normal climate for Spink County is "dry subhumid," which means that there is little or no surplus of water in any season.

Wind, Hail, and Sunshine. In Spink County the prevailing wind direction during the growing season is generally from the south-southeast, and during the rest of the year from the north-northwest. The wind velocity averages about 10 miles per hour with occasional velocities exceeding 20 miles per hour. Hot dry winds sometimes catch a crop in critical condition and do great damage, especially when soil moisture is depleted.

No data are available on hail frequency for Spink County, but the weather records from Huron, located about 40 miles south of Redfield, indicate that hail frequency

Table 1. Average Monthly Temperatures for Redfield (Degrees Fahrenheit)

Year	Month J	F	M	A	M	J	J	A	S	O	N	D	Yearly Average
1900	23.0	11.6	27.6	50.5	61.0	67.7	70.5	74.9	58.4	52.0	28.2	25.3	45.9
1901	20.6	16.2	32.9	46.6	59.0	66.2	76.7	71.0	56.8	49.4	30.2	16.2	45.1
1902	17.1	15.3	32.1	42.0	58.4	60.3	70.4	66.8	55.0	46.8	31.0	10.1	42.1
1903	12.2	6.9	26.0	44.3	56.8	64.6	69.4	66.7	55.4	49.4	27.9	12.1	41.0
1904	5.7	2.8	27.2	39.8	55.8	64.0	67.7	67.4	58.2	50.8	35.6	16.6	41.0
1905	4.6	7.4	36.6	43.2	51.3	62.6	55.2	71.0	63.0	42.2	34.4	16.2	40.6
1906	15.4	15.0	19.3	48.0	56.8	63.0	69.0	68.2	62.6	45.6	28.6	15.4	42.2
1907	1.0	16.2	32.6	36.7	46.6	63.3	68.8	68.4	55.3	45.0	32.3	24.0	40.8
1908	19.3	16.5	28.1	46.6	54.4	63.4	70.6	66.7	66.1	46.2	33.8	17.5	44.1
1909	7.8	13.4	30.0	38.6	55.3	67.1	70.0	73.7	60.2	44.4	30.4	10.0	41.7
1910	11.7	7.6	44.8	50.6	53.3	65.6	69.1	65.4	58.5	53.0	30.6	17.3	44.0
1911	7.4	14.2	34.2	44.2	59.7	73.3	66.4	66.7	59.5	44.6	19.9	18.4	42.4
1912	3.0	13.8	20.6	47.8	58.5	64.8	72.4	68.0	56.5	47.2	36.6	22.5	42.6
1913	11.6	12.0	21.0	48.4	55.0	71.3	71.4	74.8	62.6	42.9	38.9	24.8	44.6
1914	19.4	5.2	29.9	44.9	57.6	67.6	75.8	68.4	62.4	53.3	37.4	10.6	44.4
1915	10.0	21.5	19.5	53.8	53.0	61.2	67.2	65.9	59.4	49.8	35.6	20.8	43.1
1916	.4	10.9	30.4	43.0	55.6	62.4	78.8	70.0	58.2	43.8	30.9	7.8	40.9
1917	5.0	4.0	23.9	40.6	54.1	63.4	75.3	68.6	60.0	37.2	37.6	7.9	39.8
1918	2.2	15.0	36.6	41.8	57.2	67.8	69.8	71.4	54.4	49.8	34.4	25.0	43.8
1919	12.0	15.7	28.0	46.2	59.0	70.4	76.0	72.2	66.0	42.2	31.4	14.5	44.5
1920	14.0	22.1	29.6	37.8	57.9	66.6	72.2	69.6	65.2	55.6	36.6	23.6	45.9
1921	25.2	29.1	36.8	49.4	58.6	75.4	76.9	71.8	62.4	51.9	27.4	23.2	49.0
1922	13.5	8.6	31.8	48.0	60.5	70.1	70.7	75.3	66.6	50.5	34.7	16.6	45.6
1923	20.8	14.6	27.8	45.6	58.1	69.4	75.0	69.0	64.6	47.2	39.8	26.9	46.6
1924	8.2	22.9	28.4	45.8	51.0	63.4	68.6	69.1	56.8	52.8	32.4	10.6	42.5
1925	11.4	23.2	37.0	54.2	56.9	65.8	71.1	74.8	66.6	39.0	33.4	18.8	46.0
1926	16.7	27.8	31.6	47.8	65.1	67.4	74.7	72.2	59.6	49.9	27.9	17.4	46.5
1927	18.2	24.5	35.3	46.7	54.2	65.8	69.6	67.8	63.6	51.6	26.8	2.8	43.9
1928	18.6	24.6	36.4	40.6	62.2	63.0	73.0	71.9	59.4	48.7	35.4	26.4	46.7
1929	1.9	7.7	36.0	47.0	55.4	67.1	76.2	74.0	58.6	50.1	28.9	19.6	43.5
1930	4.2	30.6	32.6	50.1	54.6	67.0	79.2	76.2	63.0	47.6	35.0	26.0	47.2
1931	26.6	33.2	32.6	48.8	56.0	76.3	78.8	73.2	69.3	52.9	34.4	22.0	50.3
1932	11.0	17.1	25.2	49.8	61.4	70.8	76.4	73.4	61.9	45.2	32.7	15.2	45.0
1933	22.8	15.8	33.4	45.8	57.4	78.8	76.3	70.8	67.6	47.8	34.1	17.3	47.3
1934	22.4	25.5	31.6	47.7	70.2	71.8	78.1	72.0	56.8	53.8	37.0	18.0	48.7
1935	10.0	31.6	37.8	40.6	53.2	65.4	80.6	73.7	63.8	48.0	26.2	20.0	45.9
1936	.4	6.6	34.6	42.2	65.6	72.1	83.6	75.7	65.8	46.7	30.2	21.7	45.4
1937	.9	14.2	31.0	44.2	62.0	67.6	78.2	80.3	65.6	49.4	31.0	17.5	45.2
1938	13.4	14.6	38.0	49.2	56.2	70.0	75.8	78.0	66.7	57.0	30.6	25.2	47.9
1939	22.3	8.2	33.8	46.2	65.8	69.2	77.6	74.3	67.2	49.6	39.2	30.8	48.7
1940	6.0	19.8	28.2	44.2	59.4	68.6	78.8	71.4	67.4	56.0	28.8	25.2	46.1
1941	15.8	17.8	30.8	50.6	63.4	69.5	77.0	75.4	64.0	49.9	35.5	27.5	48.1
1942	23.3	21.6	34.6	51.6	54.6	66.6	72.0	72.0	57.3	50.0	33.8	16.5	46.2
1943	4.3	22.7	26.5	49.8	55.4	67.8	76.6	73.5	60.6	51.8	32.2	26.3	45.6
1944	27.0	16.2	24.6	42.9	63.6	67.4	72.2	71.0	61.8	51.4	34.6	22.4	46.3
1945	18.2	21.0	40.2	43.6	53.8	61.2	72.6	71.8	60.8	49.9	31.6	13.0	44.8
1946	17.0	19.9	42.0	54.0	54.8	68.8	74.6	68.7	61.1	46.6	31.8	22.6	46.8
1947	24.6	15.9	29.4	42.8	54.6	64.4	73.6	78.4	63.8	56.8	29.2	17.6	45.9
1948	12.0	12.7	26.6	50.4	58.8	65.6	74.7	72.1	66.9	48.6	33.4	18.3	45.0
1949	7.3	10.1	29.7	48.9	61.0	69.0	75.4	75.1	57.9	48.2	40.0	17.6	45.0
1950	.7	15.8	24.3	37.4	53.8	67.5	69.5	68.1	61.4	50.9	27.3	15.6	41.0
1951	9.9	22.4	18.1	42.2	58.2	60.9	71.0	69.4	56.8	46.5	28.4	9.9	41.1
1952	7.1	20.0	20.6	48.1	58.0	71.2	73.3	71.4	66.1	45.3	33.4	22.4	44.7
Average Monthly Temperatures	12.5	16.6	30.5	45.9	57.6	67.2	73.3	71.6	61.6	48.5	32.4	18.6	Average Yearly Temperature 44.7

Table 2. Average Annual Precipitation by Months and Yearly Average Precipitation*

Year	Month J	F	M	A	M	J	J	A	S	O	N	D	Yearly Total
1900	0.10	0.32	2.16	3.54	0.49	2.36	3.49	6.09	4.28	1.41	0.19	0.09	24.52
1901	0.11	0.20	0.43	0.11	1.68	5.03	1.67	2.24	3.95	1.84	0.14	0.77	18.17
1902	0.18	0.23	1.85	1.53	2.16	3.28	2.49	3.14	0.30	0.53	0.37	1.49	17.55
1903	0.11	0.54	0.93	2.06	1.44	3.51	2.99	2.58	2.31	0.51	0.28	0.43	17.69
1904	0.13	0.48	0.48	2.30	2.93	2.74	2.09	2.65	1.57	0.78	0.10	0.39	16.64
1905	0.28	0.55	0.28	0.99	5.98	5.32	3.27	3.75	0.56	2.16	1.40	0.04	24.58
1906	0.34	0.23	0.60	3.08	5.79	1.96	1.58	5.42	2.63	2.18	0.58	0.59	24.98
1907	1.08	0.39	0.55	0.75	3.00	2.14	2.88	1.36	1.51	1.42		0.26	15.34†
1908	0.14	0.82	1.13	1.74	4.43	4.96	4.06	2.17	0.75	2.70	1.24	0.66	24.80
1909	0.42	0.64	0.18	0.38	4.75	2.50	4.46	3.07	1.47	1.58	1.12	1.40	21.97
1910	0.78	0.25	0.58	1.11	1.02	2.17	0.91	2.30	0.90	0.83	0.18	0.26	11.29
1911	0.19	0.62	0.52	1.21	2.61	1.47	2.64	3.21	2.30	1.68	0.54	0.54	17.53
1912	0.29	0.09	0.24	3.56	2.02	1.31	3.45	2.54	1.22	0.16		0.30	15.18†
1913	0.05	0.27	0.47	1.50	4.69	1.26	3.55	1.52	0.51	1.70	0.30	0.16	15.98
1914	0.56	0.69	0.47	4.06	3.48	8.86	1.31	2.07	2.57	1.51		0.34	25.92†
1915	0.46	2.28	0.92	2.24	3.14	4.66	4.17	1.90	1.66	1.93	0.45	0.61	24.42
1916	1.64	0.48	1.06	1.28	5.01	3.11	2.09	5.46	1.48	0.51	0.26	1.21	23.59
1917	2.09	0.91	2.00	3.43	1.45	1.68	2.18	1.01	2.53	0.06	0.15	0.32	17.81
1918	0.11	1.42	0.58	2.22	4.59	5.06	3.19	0.94	0.69	1.88	2.18	0.14	23.00
1919	0.47	0.66	1.54	2.48	3.71	2.55	3.66	2.98	0.51	0.59	2.20	1.23	22.58
1920	0.54	0.41	2.44	2.43	4.74	5.54	4.11	1.49	1.68	0.83	1.00	0.41	25.62
1921	0.15	0.12	1.12	3.19	2.18	0.90	4.54	3.14	5.06	1.37	0.81	0.27	22.85
1922	1.25	2.15	1.44	1.68	4.17	2.90	0.65	0.45	0.32	1.48	3.05	0.25	19.79
1923	0.38	0.18	0.37	1.54	2.53	4.62	3.20	2.07	2.23	0.53	0.30	0.20	18.15
1924	0.10	0.63	1.54	1.36	0.99	6.34	1.35	3.49	1.95	2.02	0.08	0.85	20.70
1925	0.83	0.11	0.14	2.17	1.02	5.86	1.58	1.33	0.88	0.28	0.47	0.32	14.99
1926	0.70	0.29	0.06	0.56	2.01	1.67	2.75	1.65	2.67	2.92	0.28	0.47	16.03
1927	0.30	0.30	0.56	3.41	2.58	2.79	3.96	2.82	1.51	0.92	0.77	0.92	20.84
1928	0.05	0.53	0.13	1.05	0.66	3.99	2.85	3.08	1.12	1.68	1.17	0.11	16.42
1929	1.80	0.85	1.92	2.83	1.49	0.71	1.43	1.20	2.45	2.20	0.45	0.31	17.64
1930	0.35	1.36	1.39	2.06	4.04	1.88	0.74	3.26	1.13	3.37	1.44	0.10	21.12
1931	0.22	0.51	0.99	0.81	2.32	1.87	0.76	0.73	1.12	1.37	0.78	1.80	13.28
1932	0.66	0.16	0.72	2.28	2.46	3.58	1.31	3.25	1.24	0.76	0.14	0.33	16.89
1933	0.19	0.12	1.54	1.27	2.28	1.60	1.92	1.31	1.46	0.09	0.17	0.68	12.63
1934	0.03	0.10	0.91	0.11	1.77	3.46	1.32	0.75	1.92	0.80	0.74	0.21	12.12
1935	0.24	0.45	1.64	5.01	1.88	3.75	2.16	3.35	0.12	0.17	0.68	0.71	20.16
1936	0.68	0.74	0.63	1.13	1.63	1.06	1.27	2.43	0.21	0.26	1.72	0.43	12.19
1937	1.37	0.79	1.64	2.22	2.23	2.66	2.39	1.06	0.84	0.22	0.25	0.63	16.30
1938	0.54	0.72	1.16	4.13	2.62	1.25	2.03	0.53	3.04	0.18	0.35	0.34	16.89
1939	1.87	0.79	0.07	0.65	2.29	5.06	1.58	0.83	0.79	1.08	0.01	0.26	15.28
1940	0.05	0.72	2.07	2.59	0.40	2.40	1.39	2.37	9.47	1.34	0.44	0.46	23.70
1941	0.67	0.20	0.46	0.44	0.86	5.28	1.23	1.95	3.08	2.80	0.13	0.18	17.28
1942	0.01	0.30	2.98	1.97	6.02	3.88	2.48	3.82	2.40	0.97	0.15	0.21	25.19
1943	0.66	0.51	0.67	0.37	2.41	5.59	2.18	2.81	0.93	1.96	0.66		18.75†
1944	0.48	0.65	0.65	2.29	3.61	4.43	4.62	3.41	1.24	0.90	1.76	0.09	24.13
1945	0.52	0.59	1.10	1.36	4.82	3.63	1.59	1.59	2.33	0.29	0.26	0.43	18.51
1946	0.08	0.86	2.19	1.81	2.37	4.64	2.71	0.93	4.05	4.22	0.74	0.28	24.88
1947	0.48	0.31	0.82	3.27	0.81	5.06	0.90	0.84	1.90	1.65	2.35	0.11	18.50
1948	0.48	0.78	0.46	2.14	0.91	5.98	2.49	1.78	1.49	1.40	0.28	0.17	18.36
1949	1.03	0.18	1.28	0.43	2.33	2.23	1.77	1.89	1.60	0.22	3.33	0.96	17.25
1950	0.58	0.80	1.22	1.06	4.45	1.50	2.53	2.54	1.77	1.30	0.29	0.25	18.29
1951	0.15	0.68	1.12	1.11	3.28	4.74	1.04	3.92	0.50	2.29	0.05	0.05	18.93
	Average Monthly Precipitation												Average Annual Precipitation
	0.52	0.58	1.01	1.89	2.74	3.40	2.37	2.35	1.85	1.30	0.75	0.47	19.2

*For 52 years, averaging data from Redfield, Mellette, Huron (Beadle County), and Faulkton (Faulk County)
†Incomplete for year

for this general area is as follows: for May, June, and July, hail can be expected somewhere in the county one day a month; for March, April, August, September, and October, hail can be expected less than one day a month; no hail comes during the remaining months of the year.

For the east central part of South Dakota where Spink County is located 70 percent of the days are sunny in summer, and 55 percent of the days are sunny in winter.

Native Vegetation

Spink County lies in an area where short, mid, and tall grasses were included in the native vegetation. The dominance of any of the three kinds of grass was determined by soil, slope, and drainage. On medium-textured, undulating, sloping or rolling upland soils, the short- and mid-grass associations occurred. Included species were blue grama, buffalo grass, green needlegrass, needle-and-thread, and sideoats grama. Also present were such forbs as silverleaf sage.

On sandy soils, and on nearly level medium-textured soils, the mid and tall grasses were dominant. Species included were big and little bluestem, Canada wildrye, prairie sandreed, and sand dropseed. Forbs present included silverleaf scurfpea and lupine.

The poorly drained soils were the habitat for tall grasses such as big and little bluestem. The imperfectly drained clay soils on flats or in slight depressions had nearly solid stands of western wheatgrass.

The hilly soils were short grass sites and consisted principally of stands of buffalo grass and blue grama.

PURPOSE AND METHODS OF SOIL SURVEYS

A SOIL SURVEY consists of a soil map and a report. (5) The purpose of the soil map is to show the distribution of the various kinds of soil. The purpose of the report is to describe each kind of soil shown on the map and to give yield predictions of adapted crops under several defined sets of management practices. Relevant facts about climate, physiography, geology, native vegetation, agriculture, and public facilities are included in the report, because they influence soil use and management. Information about agricultural systems, grazing, erosion control, irrigation, and fertilization is presented to bring out specific relationships to individual soils or groups of soils.

The yield predictions given in the report are a summary of all of the available management information of the soils shown on the map. These predictions provide a connecting link between agronomic research and farmer's fields. They provide the basis for farm planning and with them land values can be related to productivity so that the soil map can be used in land evaluation.

How the Soil Survey Is Made

The method used in making a soil survey is first to examine, classify, and map the soils in the field. While this is being done samples of the major soils in the area are taken and analysed; experimental work on soil management is performed; and crop yield data are collected from farm records, questionnaires, and experimental plots. The final steps include correlation of the soils and publishing the results as a soil map and report.

The examination of the soils in a number of places is the first step in the soil survey. Holes are dug with a spade and auger which allow the surveyor to examine the individual soil layers or horizons which collectively are called the soil profile. Each horizon of the profile including the parent material is studied and described as to color, texture (percentage of sand, silt, and clay present), structure (arrangement of aggregates), and consistence (resistance of structural aggregates to crushing). The presence of lime or salts is determined by simple tests. Other characteristics observed are the topography, soil drainage, and the native vegetation. From these features certain qualities of the soil become apparent, such as the fertility and tilth, its productivity, the erosion hazard, and the adaptability of the soil for irrigation.

The soils are classified on the basis of their characteristics. The three principal units of classification used are *soil series, soil type,* and *soil phase.* The mapping units of the Spink County survey are types and phases. Besides these two, certain areas have such intricate patterns of soil types and phases that they are mapped as complexes. A soil complex is an area where two or more soil types or phases form such a complicated pattern that the individual types and phases cannot be separated on scale of map used.

The series is a group of soils having the same kinds of horizons, which are alike in their important characteristics and arrangement in the profile, and overlie similar parent material. Series are given geographic names selected in the localities where they were first identified. Harmony, Bonilla, and Aberdeen are names of important series in Spink County.

Within a series there may be one or more types, designated according to the texture of the surface. Soil types are named by combining the name of the texture class with the name of the series. Houdek loam and Houdek silt loam are soil types within the Houdek series.

The phase is a subdivision of the soil type, separated because of some feature of practical significance. Examples of such features are stoniness, degree of erosion, and slope. Beadle silt loam, for example, is divided into several phases because of differences in stoniness and salinity of the parent material (substrata): (1) Beadle silt loam, stony, (2) Beadle silt loam, nonsaline substratum. The term "phase" is omitted to shorten the name.

After the soils have been studied in the field a legend is prepared, aerial photographs for a base map are

obtained, and mapping begins. Mapping consists of traversing the land, digging holes to examine and classify the soils, and sketching in the boundaries of the different soil types and phases on the aerial photograph. Slopes are determined by means of an Abney hand level and erosion is estimated.

In the Spink County soil survey, 32 complete soil profiles were analysed for texture, salinity, exchangeable bases, and certain physical constants by the United States Division of Soil Survey. In addition, 730 complete profiles were analysed for salinity and pH by the South Dakota State College Agricultural Experiment Station. These results along with salinity and pH analyses of 950 soil profiles by the United States Bureau of Reclamation have been used where applicable.

Experimental work involving kind of fertilizers, method of applying fertilizers, and also rotations was performed by the South Dakota State College Agricultural Experiment Station on selected major soil types in Spink County. The yield predictions made for the soils were based on these studies and on records obtained through the cooperation of Spink County farmers.

After the field mapping is completed and the experimental results are summarized, the soils are correlated, and the soil map and report are published. Correlation is the process of comparing the local soil types, phases, and complexes with those already defined and named in the general system of classification. Where necessary new soil types are recognized, established, and named. A number of new soil types were set up for the Spink County soil survey. It was found that soil series like Barnes, which previously were mapped across most of eastern South Dakota, have been too broadly defined. By the use of more sharply defined soil series, more precise yield predictions are possible.

SOILS OF SPINK COUNTY

THE SOILS OF SPINK COUNTY are discussed under three subheads in this section: (1) Formation of the Soils; (2) Soil Series and their Relationships; and (3) Soil Types and Phases. Under subhead (3) the individual soils are listed alphabetically and described. These descriptions include information on the drainage, consistence, slope, physiographic position, general location in the county, parent material, permeability, salts and alkali, waterholding capacity, tilth, fertility, erosion hazard, irrigability, and special problems of use and management.

General information on management principles and yield predictions for several defined sets of management practices can be found in the section entitled, "Use, Management, and Productivity of the Soils of Spink County."

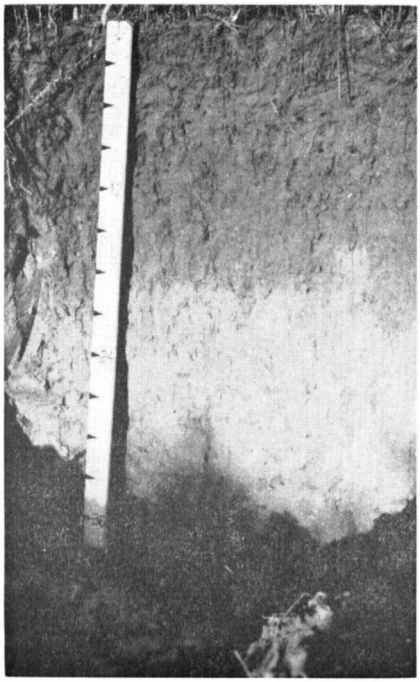


Photo by W. M. Johnson, SCS

Profile of Great Bend silt loam showing granular A horizon (0-8 inches), prismatic B horizon (8-18 inches), and lighter colored C horizon (parent material). This soil was formed from laustrine material on slightly sloping topography.

Formation of the Soils

Soil management knowledge can be applied better with an understanding of the formative processes of the soils. This understanding will aid in explaining why different soils are favorable sites for certain crops and why they require different management practices if they are to continue yielding well.

Soil formation starts when parent material has accumulated. In Spink County, the soil parent materials are of glacial origin and include lacustrine materials, glacial till, outwash, alluvium, and loess. While the process of grinding the glacial materials was taking place, chemical weathering of rock minerals (which continues throughout soil formation) released certain simple compounds which serve as food for bacteria and fungi. These simple forms of life lived and died by the millions and their bodies decayed in the rock debris, and thus organic matter began accumulating. Gradually the developing soil was able to support higher forms of plant and animal life. The present accumulation of soil organic matter is due principally to the activity of these higher forms of plant life. As the higher forms of plant life grow, the upper layers of the loose mass of parent materials slowly change as organic matter accumulates and leaching takes place. This development of layers is the beginning of the soil profile.

A soil profile, which can be seen on the wall of a fresh road cut, consists of a succession of layers or horizons in a vertical section down through the soil. In most Spink County soil profiles the horizons are separated by transitional zones, although some of the profiles have sharply defined boundaries between horizons. The uppermost layer is the A horizon, commonly called the surface soil; the second horizon is the B horizon, commonly called the subsoil, and the third is the C horizon often called the parent material. The upper part of the C horizon of Spink County soils is enriched with lime leached from the A and B horizons. This lime-enriched layer is

called the horizon of lime accumulation and is designated "Cca," the subscript *ca* referring to calcium carbonate.

The major A, B, and C horizons may be subdivided by using subscripts such as A_1 and A_2. The principal horizons and subscripts used for Spink County soils are, A_1 (the horizon of maximum organic matter accumulation), A_2 (a light gray leached layer found in claypan soils), B_2 (horizon of maximum structure), and Cca.

All of these horizons do not occur in all soils. The A and B horizons, the horizon of lime accumulation, and the upper part of the parent material ordinarily occur within a depth of 5 feet in Spink County.

The steps of soil formation include the accumulation of parent material, the addition of organic matter, and the differentiation of a soil profile. They occur in every soil. The processes operating in each of the three steps differ, however, from place to place. If the parent material is sandy, the soil developed in it has different properties than a soil developed in clay. Similarly, soils developed in different climatic regions, or under different vegetation, or topographic positions, will not be the same.

The nature of soils is determined by the combined influences of climate, vegetation, parent material, topography, and age (the interval soils have been developing). Climate and vegetation usually cause regional differences in soils, as between South Dakota and Ohio. Local differences such as those among the soils of Spink County are commonly due to differences in parent material, topography, and age.

Soil Series and Their Relationships

The principal characteristics of the soil series of Spink County are shown in Table 3. This table and Fig. 5 showing the physiographic position and parent materials are designed to bring out the interrelationships among the soil series in the county.

Profile of Tetonka silt loam developed in clayey sediments in a depressional position. Note the dark colored A_1 horizon (0-6 inches) overlying the white A_2 horizon which carries down to 1 foot, and the black subsoil which carries down to below 3 feet.

Photo by C. A. Mogen, SCS

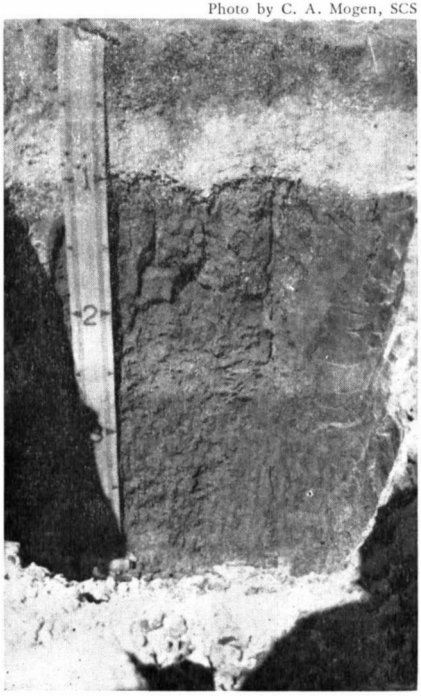


Table 3. Principal Characteristics of the Soil Series of Spink County, South Dakota

Soil Series	Parent Material	Physiographic Position	Slope	Natural Drainage	General Profile Texture	Subsoil Consistence
Aberdeen	Lacustrine	Lake Bed	Level	Imperfect	Moderately Fine	Compact
Beadle	Glacial Till	Upland	Nearly Level	Well	Moderately Fine	Firm
Beotia	Lacustrine	Lake Bed	Nearly Level	Well	Medium	Friable
Bonilla	Glacial Till	Upland	Nearly Level	Moderate	Medium	Friable
Cavour	Glacial Till	Upland	Level	Imperfect	Moderately Fine	Compact
Crandon	Outwash	Upland	Hilly	Excessive	Coarse	Loose
Cresbard	Glacial Till	Upland	Level	Moderate	Medium	Friable
Doland	Loess	Upland	Undulating	Well	Medium	Friable
Eckman	Lacustrine	Lake Bed	Nearly Level	Well	Moderately Coarse	Friable
Exline	Alluvium	Flood Plain	Level	Poor	Fine	Compact
Great Bend	Lacustrine	Lake Bed	Sloping	Well	Medium	Friable
Groveland	Outwash	Upland	Undulating	Well	Moderately Coarse	Friable
Hamar	Outwash	Outwash Plain	Level	Poor	Coarse	Loose
Hamerly	Glacial Till	Upland	Level	Imperfect	Medium	Friable
Hand	Glacial Drift	Upland	Nearly Level	Well	Medium	Friable
Harmony	Lacustrine	Lake Bed	Level	Imperfect	Moderately Fine	Firm
Hecla	Outwash	Outwash Plain	Nearly Level	Well	Coarse	Loose
Houdek	Glacial Till	Upland	Undulating	Well	Medium	Friable
La Delle	Old Alluvium	Terrace	Level	Well	Medium	Friable
Lamoure	Alluvium	Flood Plain	Level	Poor	Moderately Fine	Firm
La Prairie	Lacustrine	Channels	Level	Imperfect	Medium	Friable
Letcher	Outwash	Outwash Plain	Level	Poor	Moderately Coarse	Compact
Maddock	Wind reworked Sandy outwash	Upland	Undulating	Well	Coarse	Loose
Maple	Alluvium	Flood Plain	Level	Poor	Moderately Fine	Firm
Northville	Old Alluvium	Terrace	Level	Imperfect	Moderately Fine	Compact
Orient	Glacial Till	Upland	Hilly	Excessive	Medium	Friable
Rauville	Alluvium	Flood Plain	Level	Very Poor	Moderately Fine	Firm
Spottswood	Outwash	Outwash Plain	Level	Moderate	Coarse	Loose
Tanberg	Outwash	Outwash Plain	Level	Poor	Coarse	Loose
Tetonka	Glacial Drift	Depressional	Level	Poor	Medium	Firm
Twin Lakes	Outwash	Outwash Plain	Nearly Level	Somewhat Excessive	Coarse	Loose
Wessington	Outwash	Outwash Plain	Nearly Level	Well	Medium over Coarse	Friable
Zell	Lacustrine	Lake Bed	Sloping to Steep	Excessive	Medium	Friable

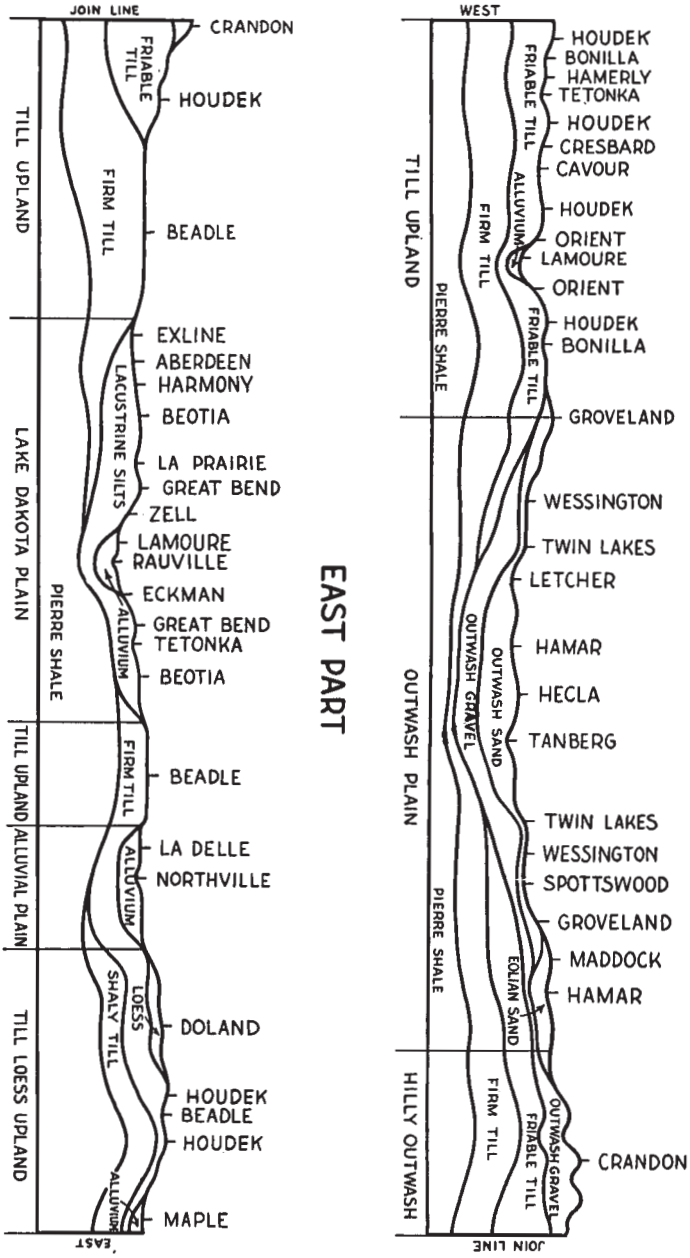


Fig. 5. Physiographic position and parent materials of the soil series of Spink County, South Dakota

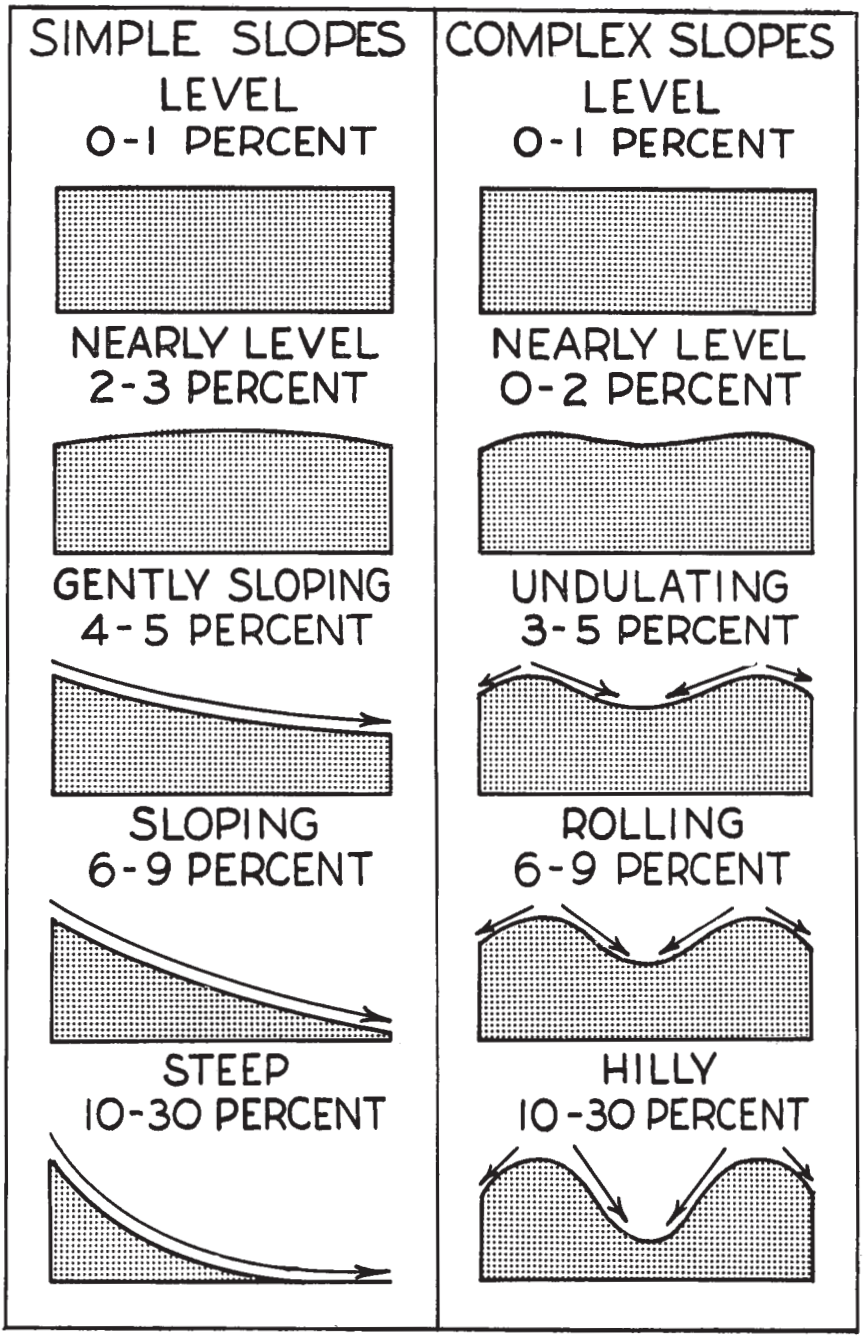


Fig. 6. Slope Terminology used for soil types and phases

Soil Types and Phases

In the following pages the soils which appear on the map are described in alphabetical order. The colors used refer to the color of the moist soil. The slope of each unit in percent is shown in parenthesis. A slope of 2 percent means a drop of 2 feet in 100 feet. Slope refers to the incline of the soil surface and is considered a part of the soil. Not only has slope affected the development of a soil in an area by controlling available moisture, but it must be considered in the use and management of the soil. For example, slope controls the rate and amount of runoff, the water erodibility of the soil, and the use of machinery.

The slope terminology used in this report is explained in Fig. 6. The terms used to describe long single slopes such as occur on the Lake Bed are: *level, nearly level, gently sloping, sloping,* and *steep.* The terms used to describe complex slopes which consist of a series of short slopes occurring on rises, knobs, and hills in an undulating or rolling terrain such as a till plain, are: *nearly level, undulating, rolling,* and *hilly.*

The principal features and qualities of the types and phases are given in the soil description and the special problems of use and management are discussed. In the section of the report entitled "Use, Management, and Productivity of the Soils of Spink County," the soils are grouped and yield predictions are made for selected management systems.

The acreage and proportionate extent of the soils shown on the soil map are given in Table 4.

Table 4. Acreage and Proportionate Extent of Soil Types and Phases

Map Number	Soil Types and Phases	Acreage	Percent
1.	Aberdeen silty clay loam, level (0-1%)	118,094	12.3
2.	Aberdeen silty clay loam, nearly level (2-3%)	3,274	0.3
3.	Aberdeen silty clay loam, till substratum, level (0-1%)	4,323	0.4
4.	Aberdeen loam, level (0-1%)	266	0.03
5.	Aberdeen-Harmony silty clay loams, level (0-1%)	19,873	2.1
6.	Beadle silt loam, nearly level (0-2%)	13,304	1.4
7.	Beadle silt loam, stony, nearly level (0-2%)	8,011	0.8
8.	Beadle silt loam, nonsaline substratum, nearly level (0-2%)	6,934	0.7
9.	Beadle silt loam, stony, nonsaline substratum, nearly level (0-2%)	13,817	1.4
10.	Beadle silt loam, undulating (3-5%)	988	0.1
11.	Beadle silt loam, nonsaline substratum, undulating (3-5%)	842	0.09
12.	Beadle-Cavour silt loams, nearly level (0-2%)	28,627	3.0
13.	Beadle-Cresbard silt loams, nearly level (0-2%)	2,626	0.3
14.	Beadle-Houdek-Cresbard silt loams, nearly level (0-2%)	2,260	0.2
15.	Beotia silt loam, level (0-1%)	21,212	2.2
16.	Beotia silt loam, moderately saline substratum, level (0-1%)	34,343	3.6
17.	Beotia silt loam, till substratum, level (0-1%)	9,390	1.0
18.	Beotia silt loam, nearly level (2-3%)	6,536	0.7

Table 4. Acreage and Proportionate Extent of Soil Types and Phases (Continued)

Map Number	Soil Types and Phases	Acreage	Percent
19.	Beotia silt loam, moderately saline substratum, nearly level (2-3%)	3,949	0.4
20.	Beotia silt loam, till substratum, nearly level (2-3%)	5,211	0.5
21.	Beotia silt loam, gently sloping (4-5%)	1,106	0.1
22.	Beotia silt loam, valley phase, nearly level (0-2%)	3,137	0.3
23.	Bonilla-Houdek loams, nearly level (0-2%)	26,027	2.7
24.	Bonilla-Houdek silt loams, nearly level (0-2%)	6,414	0.7
25.	Bonilla-Cresbard silt loams, nearly level (0-2%)	1,242	0.1
26.	Bonilla-Houdek fine sandy loams, nearly level (0-2%)	2,676	0.3
27.	Bonilla-Houdek fine sandy loams, firm till substratum, nearly level (0-2%)	816	0.09
28.	Bonilla-Groveland fine sandy loams, nearly level (0-2%)	1,153	0.1
29.	Cavour-Beadle silt loams, nearly level (0-2%)	10,259	1.1
30.	Cavour-Houdek loams, nearly level (0-2%)	5,381	0.6
31.	Cavour thin surface-Tetonka complex, nearly level (0-2%)	11,515	1.2
32.	Crandon-Houdek loams, hilly (10-15%)	982	0.1
33.	Cresbard-Beadle silt loams, nearly level (0-2%)	2,435	0.3
34.	Cresbard-Bonilla silt loams, nearly level (0-2%)	2,450	0.3
35.	Doland silt loam, nearly level (0-2%)	5,452	0.6
36.	Doland silt loam, loamy fine sand substratum, gently sloping (3-5%)	953	0.1
37.	Doland silt loam-Solonetz complex, nearly level (0-2%)	1,400	0.1
38.	Eckman loam, nearly level (2-3%)	6,364	0.7
39.	Eckman loam, level (0-1%)	6,175	0.6
40.	Eckman loam, gently sloping (4-5%)	1,131	0.1
41.	Eckman loam, sloping (6-9%)	269	0.03
42.	Eckman loam, valley phase, nearly level (0-2%)	1,234	0.1
43.	Eckman fine sandy loam, nearly level (0-2%)	1,394	0.1
44.	Exline complex, level (0-1%)	34,181	3.5
45.	Exline complex, nearly level (2-3%)	851	0.09
46.	Great Bend silt loam, gently sloping (4-5%)	3,219	0.3
47.	Great Bend silt loam, nearly level (2-3%)	20,185	2.1
48.	Great Bend silt loam, level (0-1%)	13,523	1.4
49.	Great Bend silt loam, sloping (6-9%)	741	0.08
50.	Great Bend silt loam, till substratum, nearly level (2-3%)	1,552	0.2
51.	Great Bend silt loam, till substratum, gently sloping (4-5%)	352	0.04
52.	Great Bend-Zell silt loams, nearly level (2-3%)	4,281	0.4
53.	Hamerly loam, nearly level (0-2%)	541	0.07
54.	Hand-Houdek loams, gently undulating (1-3%)	3,702	0.4
55.	Harmony silty clay loam, level (0-1%)	78,472	8.2
56.	Harmony silty clay loam, nearly level (2-3%)	1,487	0.1
57.	Harmony silty clay loam, till substratum, level (0-1%)	5,574	0.6
58.	Harmony loam, level (0-1%)	398	0.04
59.	Hecla sandy loam, nearly level (0-2%)	12,812	1.3
60.	Hecla sandy loam, till substratum, nearly level (0-2%)	1,092	0.1
61.	Hecla loamy fine sand, nearly level (0-2%)	4,699	0.5
62.	Hecla loamy fine sand, till substratum, nearly level (0-2%)	936	0.1
63.	Hecla-Hamer loamy fine sands, nearly level (0-2%)	1,981	0.2
64.	Hecla-Hamer loamy fine sands, wind eroded, hummocky (0-2%)	2,018	0.2
65.	Hecla-Letcher loamy fine sands, nearly level (0-2%)	1,237	0.1
66.	Hecla-Letcher sandy loams, nearly level (0-2%)	5,189	0.5
67.	Houdek-Bonilla loams and silt loams, undulating (3-5%)	56,501	5.9
68.	Houdek-Bonilla loams and silt loams, stony, undulating (3-5%)	516	0.05
69.	Houdek-Bonilla silt loams, undulating (3-5%)	28,825	3.0

Table 4. Acreage and Proportionate Extent of Soil Types and Phases (Continued)

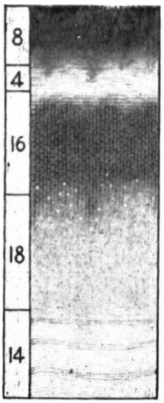
Map Number	Soil Types and Phases	Acreage	Percent
70.	Houdek-Bonilla silt loams, stony, undulating (3-5%)	538	0.06
71.	Houdek loam-Crandon gravelly loam, undulating (3-5%)	3,677	0.4
72.	Houdek silt loam, firm till substratum, undulating (3-5%)	37,632	3.9
73.	Houdek-Cavour loams and silt loams, gently undulating (2-3%)	3,458	0.4
74.	Houdek-Bonilla fine sandy loams, undulating (3-5%)	9,166	0.9
75.	Houdek-Groveland fine sandy loams, undulating (3-5%)	3,776	0.4
76.	Houdek fine sandy loam, thin solum, undulating (3-5%)	1,509	0.2
77.	Houdek loam, thin solum, undulating (3-5%)	4,566	0.5
78.	Houdek loam, rolling (6-9%)	671	0.07
79.	Houdek silt loam, rolling (6-9%)	1,127	0.1
80.	Houdek loam, thin solum, rolling (6-9%)	5,855	0.6
81.	Houdek silt loam, firm till substratum, rolling (6-9%)	1,360	0.1
82.	Houdek loam-Crandon gravelly loam, rolling (6-9%)	7,718	0.8
83.	Houdek loam, very stony, rolling (6-9%)	1,340	0.1
84.	Houdek-Orient loams, hilly (10-30%)	1,601	0.2
85.	Houdek-Orient loams, very stony, hilly (10-30%)	3,595	0.4
86.	La Delle silt loam, level (0-1%)	19,375	2.0
87.	La Delle silt loam, nearly level (2-3%)	1,244	0.1
88.	La Delle silty clay loam, level (0-1%)	2,770	0.3
89.	La Delle-Lamoure silt loams, nearly level (0-2%)	7,156	0.7
90.	La Delle-Northville silty clay loams, level (0-1%)	19,016	2.0
91.	La Delle-Northville silt loams, level (0-1%)	4,564	0.5
92.	Lamoure silty clay loam	17,321	1.8
93.	Lamoure silty clay loam, saline	1,035	0.1
94.	La Prairie-Tetonka silt loams, nearly level (0-2%)	14,390	1.5
95.	Maddock sandy loam, undulating (3-5%)	1,224	0.1
96.	Maddock loamy fine sandy, till substratum, undulating (3-5%)	4,396	0.5
97.	Maddock-Hamar loamy fine sands, wind eroded, hummocky (3-5%)	2,703	0.3
98.	Maple silty clay loam	8,110	0.8
99.	Orient-Crandon complex, stony, hilly (10-30%)	3,199	0.3
100.	Rauville silty clay loam	1,604	0.2
101.	Spottswood loam, nearly level (0-2%)	2,585	0.3
102.	Tanberg loamy fine sand	2,209	0.2
103.	Tetonka silt loam	26,279	2.7
104.	Tetonka silt loam, poorly drained	15,287	1.6
105.	Twin Lakes-Wessington loams, nearly level (0-2%)	245	0.03
106.	Twin Lakes-Wessington loams, undulating (3-5%)	612	0.06
107.	Wessington loam, nearly level (0-2%)	3,886	0.4
108.	Wessington loam and sandy loam, nearly level (0-2%)	3,547	0.4
109.	Wessington loam and sandy loam, undulating (3-5%)	884	0.09
110.	Zell-Great Bend silt loams, gently sloping (4-5%)	4,587	0.5
111.	Zell-Great Bend silt loams, eroded, sloping (6-9%)	3,630	0.4
112.	Zell-Great Bend silt loams, eroded, steep (10-30%)	684	0.07
	Lakes and intermittant ponds	3,788	0.4
	Marshes	2,921	0.3
	Streams	3,241	0.3
	Artesian ponds	2,065	0.2
	Towns	801	0.08
	Railroad and highway rights of way	1,867	0.2
	Miscellaneous (gravel pits, escarpments)	316	0.03
	Total	**963,840**	**100.00**

No. 1 Aberdeen Silty Clay Loam, Level (0-1%)

This is an imperfectly drained claypan soil occurring on level positions on the Glacial Lake Dakota Plain. It is extensive, and usually occurs in large bodies away from stream valleys. The parent material is lake-laid silts and clays. The claypan subsoil is only slowly permeable and salts and alkali are usually present in moderate amounts below the subsoil. There are no stones in or on the soil. A profile diagram is shown (Fig. 7) along with a profile description.

Aberdeen silty clay loam is a moderately fertile soil of fair tilth. It is not subject to water erosion and is subject to wind erosion only during periods of prolonged drought. This unit is a poor prospect for irrigation, due principally to the low permeability of the subsoil and parent material.

Fig. 7. Aberdeen silty clay loam



A_1 0-8″ Black, friable silty clay loam of weak granular structure, high in organic matter

A_2 8-12″ Dark gray, friable silty clay loam of blocky or platy structure

B_2 12-28″ Very dark gray, compact silty clay of blocky structure

C_{ca} 28-46″ Dark yellowish-brown, friable silty clay loam of massive structure, highly calcareous, usually moderately saline

C46-60″ Light yellowish-brown, friable, laminated, silts and clays, calcareous, usually moderately saline

Use and Management. Aberdeen silty clay loam is used principally for the production of small grains. Corn is not an adapted crop because of the presence of the claypan subsoil which is poorly areated and which restricts root growth and moisture penetration. The principal management problems are delayed planting as a result of wet soil, maintaining a supply of available nitrogen, and maintaining tilth.

Practices which will aid in the solution of these problems are the use of legumes which provide a source of nitrogen and organic matter, the use of commercial nitrogen, and timely tillage to prevent loss of tilth. See discussion of Soil Management Practices and Principals for details. This soil is in Management Group 6 for crop yield predictions.

No. 2 Aberdeen Silty Clay Loam, Nearly Level (2-3%)

This soil differs from soil No. 1 by occurring on nearly level rather than level slopes. It is of rather limited extent and occurs at the lower parts of

very slight slopes or on nearly uniform slopes broken by shallow swales. In other characteristics and qualities this soil resembles soil No. 1.

Use and Management. This unit is used the same as unit No. 1 and has similiar problems of management except that ponding is more serious here because water tends to collect in seep positions on the lower parts of the slopes and in shallow swales. This soil is in Management Group 6 for crop yield predictions.

No. 3 Aberdeen Silty Clay Loam, Till Substratum, Level (0-1%)

This soil is of limited extent, being confined in Spink County to the eastern border of the Lake Dakota Plain where the lake-laid sediments are 36 to 60 inches thick overlying the glacial till. The presence of the till substratum sets this soil out from soil No. 1. In other characteristics this soil resembles unit No. 1, and it generally has the same qualities except that the glacial till substratum makes this soil even more unsuitable for irrigation than is unit No. 1.

Use and Management. This soil is used the same as unit No. 1 and has the same management problems. This soil is in Management Group 6 for crop yield predictions.

No. 4 Aberdeen Loam, Level (0-1%)

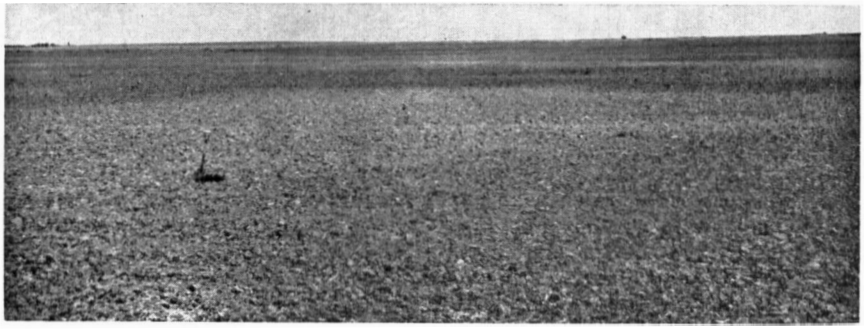
This soil occurs principally in the northern part of the Glacial Lake Dakota Plain in Spink County and is of limited extent. It differs from soil No. 1 in having a loam, rather than a silty clay loam surface soil. In other characteristics this soil resembles unit No. 1.

Aberdeen loam complex is a moderately fertile soil of good tilth. It is not subject to water erosion but is slightly susceptible to wind erosion. This soil is a poor prospect for irrigation due primarily to the low permability of the subsoil and parent material.

Use and Management. Aberdeen loam complex is used principally for the production of small grains. Corn does better on this soil than it does on unit No. 1 although the presence of the claypan subsoil prevents it from being a good corn soil. Because of its loamy surface, the problem of ponding on this soil is not as acute as it is on unit No. 1 and tilth is easier to maintain. This soil is in Management Group 6 for crop yield predictions.

No. 5 Aberdeen-Harmony Silty Clay Loams, Level (0-1%)

This complex consists of two level soils, the Aberdeen with a very compact subsoil and the Harmony with a slightly compact subsoil. The complex is composed of about 60 percent Aberdeen and 40 percent Harmony. For descriptions of the profiles see unit No. 1 for Aberdeen silty clay loam and unit No. 55 for Harmony silty clay loam.



Landscape of Aberdeen-Harmony silty clay loams. The lighter colored areas are slightly depressed and are occupied by the Aberdeen soils; the darker colored areas are the sites for the Harmony soils.

This unit is of fairly wide extent and occurs as large irregularly shaped areas principally in the central and eastern parts of the Lake Dakota Plain in Spink County. Although the general slope is level it is interrupted by gentle rises and shallow swales that differ in elevation only 1 to 3 feet or less. The Harmony soils occupy the gentle rises in this landscape while the Aberdeen soils occur in the shallow swales.

This complex is moderately fertile and has fair tilth. It is not subject to water erosion and is subject to wind erosion only during periods of prolonged drought. This unit is a poor prospect for irrigation because of the compact claypan of the Aberdeen soil and because of the minor slope irregularities of the entire unit.

Use and Management. This complex is used principally for the production of small grains. Corn, although it does fairly well on the Harmony soil, does not grow well on the Aberdeen. The principal management practices must be keyed to the Aberdeen soil and should provide for maintenance of tilth, maintenance of a supply of available nitrogen, and delayed planting. This soil is in Management Group 6 for crop yield predictions.

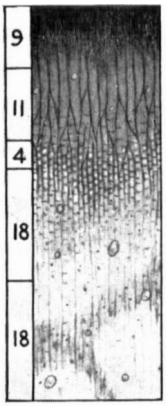
No. 6 Beadle Silt Loam, Nearly Level (0-2%)

This is a well-drained soil with a firm subsoil and firm parent material occurring on a nearly level till plain. Although appearing nearly level, about 15 percent of the landscape consists of gentle swales in which the Cavour soils (described in unit No. 29) are found. In Spink County this unit occurs as rather large, irregularly-shaped bodies along the entire east side of the county (Soil Area E, Fig. 3). The subsoil is moderately permeable and the parent material slowly permeable. Slight to moderate concentrations of salts and alkali are present in the parent material. Scattered stones occur on the surface and within the soil profile. This is not an extensive soil in Spink County. A profile diagram and description are shown in Fig. 8.

Beadle silt loam, nearly level, is a fertile soil with fair to good tilth. It is not subject to water erosion but is slightly susceptible to wind erosion. It is a fair prospect for irrigation.

Use and Management. This soil is used principally for the production of small grains and corn. The principal management problems are maintaining a supply of available nitrogen and maintenance of tilth. Legumes will supply a source of available nitrogen and also aid in maintaining tilth because of added organic matter. Commercial nitrogen fertilizer or manure can also supply available nitrogen. Timely tillage is important in maintaining tilth. This soil is in Management Group 4 for crop yield predictions.

Fig. 8. Beadle silt Loam



A_1 0-9″ Black, friable, silt loam of granular structure

B_2 9-20″ Very dark grayish-brown, firm clay loam of strong prismatic and blocky structure

B_{ca} 20-24″ Very dark grayish-brown, firm clay loam of strong prismatic and blocky structure, splotched with white lime spots ½ to 1″ in diameter

C_{ca} 24-42″ Grayish-brown, firm, calcareous, clay loam glacial till of blocky structure splotched with white lime spots

C-42-60″ Olive Gray, firm, calcareous, clay loam glacial till of blocky structure, few white lime spots

No. 7 Beadle Silt Loam, Stony, Nearly Level (0-2%)

This soil differs from unit No. 6 by having many stones scattered on and in the soil. It is estimated that there are present from 5 to 20 cubic yards-per-acre-foot of stones larger than 10 inches in diameter. In Spink County this soil is of rather limited occurrence and is found chiefly in the southeastern part of the county. In soil qualities this soil is similar to unit No. 7 except that stoniness renders it a poor rather than fair prospect for irrigation.

Use and Management. The degree of stoniness of this soil interferes with tillage operations so that this soil is used principally for pasture and hayland. It is an excellent pasture soil and good crops of hay are produced. If cleared of stones this soil is used and managed the same as unit No. 6, the nonstony type. This Soil is in Management Group 4 for yield predictions.

Landscape of Beadle silt loam, stony. Although stoniness limits cultivation on this field, the Beadle soil is fertile and produces good grass.

No. 8 Beadle Silt Loam, Nonsaline Substratum, Nearly Level (0-2%)

This soil is similar in all respects but one to unit No. 6. The difference is that the substratum (or parent material) of this soil is nonsaline while slight to moderate concentrations of salts and alkali are found in the substratum of unit No. 6. This Soil is limited in extent and is confined to the south central area of Spink County in Soil Area D, Fig. 3. It is a fair prospect for irrigation.

Use and Management. This soil is used and managed the same as unit No. 6. The fact that this soil has a nonsaline substratum while that of unit No. 7 is saline, does not affect its use and management under nonirrigated farming. This salinity may be significant if the soil is irrigated. This soil is in Management Group 4 for crop yield predictions.

No. 9. Beadle Silt Loam, Stony, Nonsaline Substratum, Nearly Level (0-2%)

This soil differs from unit No. 6, described above, in two respects: it has present from 5 to 20 cubic-yards-per-acre-foot of stones larger than 10 inches in diameter, while unit No. 6 has only scattered stones present; and the substratum (parent material) of this unit is nonsaline while that of unit No. 6 has slight to moderate concentrations of salts present. This soil occurs in the south central part of the county and is confined to Soil Area D, Fig. 3. It is of limited occurrence in Spink County. This soil is a poor prospect for irrigation.

Use and Management. The degree of stoniness of this soil interferes with tillage operations so that this soil is used principally for pasture and hayland. For these purposes this is an excellent soil. If cleared of stones this soil is used and managed the same as unit No. 6, the nonstony type. Salin-

ity of the substratum (parent material) does not affect the use of the soil for nonirrigated farming although it may be significant if the soil is irrigated. This soil is in Management Group 4 for crop yield predictions.

No. 10 Beadle Silt Loam, Undulating (3-5%)

This soil differs from unit No. 6, described above, by occurring on undulating rather than nearly level terrain. The soil occurs on undulating areas which consist of a series of rather low, round-topped hills separated by gently sloping swales and occasional sloughs. A few stones are scattered on and in the soil. The soil is of limited extent in Spink County and occurs in the eastern part of the county. The soil is a poor prospect for irrigation.

Use and Management. This soil is used and managed like unit No. 6. Water erosion may become serious on the crests of the slopes of the low hills. Areas affected are small and of irregular shape and usually used for hayland. This soil is in Management Group 14 for crop yield predictions.

No. 11 Beadle Silt Loam, Nonsaline Substratum, Undulating (3-5%)

This soil is of limited extent in Spink County and occurs in the south central part of the County in Soil Area D, Fig. 3. It is similar in soil characteristics and qualities to unit No. 6 except that it has slight to moderate concentrations of salts and alkali, and it occurs on undulating terrain while unit No. 6 is nearly level. A few stones are scattered on and in the soil. This soil is a poor prospect for irrigation.

Use and Management. This soil is used and managed like unit No. 6. Water erosion may become serious on the crests of the slopes of the low hills. The areas affected are small and of irregular shape and are difficult to manage unless used for hayland or pasture. This soil is in Management Group 14 for crop yield predictions.

No. 12 Beadle-Cavour Silt Loams, Nearly Level (0-2%)

This complex consists of two nearly level soils, the Beadle with a firm subsoil and the Cavour with a very compact subsoil. The parent material of both soils is firm glacial till of clay loam texture. The complex is composed of about 60 percent Beadle and 40 percent Cavour. For descriptions and diagrams of the profiles see unit No. 6 for Beadle and unit No. 29 for Cavour.

This complex is of fairly wide extent and occurs as large bodies in the eastern part of Spink County (Soil Area E, Fig. 3). It occurs on nearly level areas which consist of a plain interrupted by gentle rises and shallow swales that differ in elevation only 1 to 4 feet or less. The Beadle soils occur on the gentle rises in this landscape while the Cavour soils occupy the shallow swales. A few stones are scattered on and in the soil.

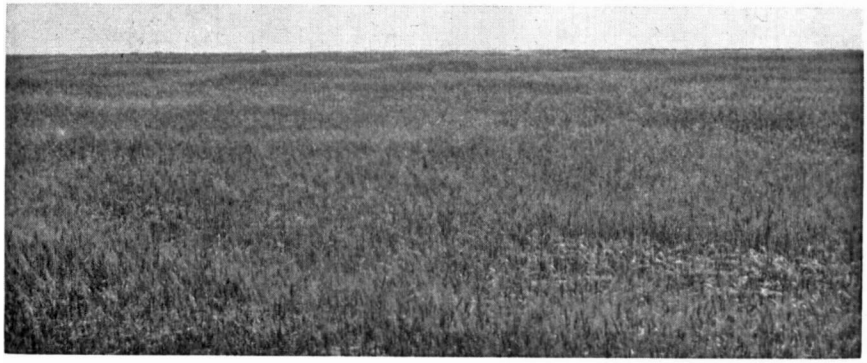


Photo by C. A. Mogen, SCS

Landscape of Beadle-Cavour silt loams. The low rises are the sites for the Beadle soils while the slight dips are occupied by the Cavour soils. The crop is spring wheat.

This complex is moderately fertile and has fair tilth. It is not subject to water erosion and is subject to blowing only during periods of prolonged drought. This unit is a poor prospect for irrigation because of the compact subsoil of the Cavour and because of the minor slope irregularities of the entire unit.

Use and Management. This complex is used principally for the production of small grains, for hayland, and for pasture. Corn, although it does fairly well on the Beadle soil, does not grow well on the Cavour because of its compact subsoil. When used for the growing of small grain, delayed planting is often caused by the wetness of the Cavour soils in the shallow swales. Maintaining tilth and a supply of available nitrogen are additional problems of management. The use of legumes can supply nitrogen and by adding organic matter will aid in maintaining tilth. The Cavour soils are often wet when the Beadle is ready to work so tillage must be planned so that the tilth is not destroyed. This soil is in Management Group 6 for crop yield predictions.

No. 13 Beadle-Cresbard Silt Loams, Nearly Level (0-2%)

This complex consists of two nearly level soils, the Beadle with a firm subsoil and the Cresbard with a friable subsoil. The parent material of both soils is firm glacial till of clay loam texture. The Beadle soil is described in No. 6 and the Cresbard in No. 33. The complex is composed of about 60 percent Beadle and 40 percent Cresbard. This complex is of limited extent and occurs principally in eastern Spink County. This complex occurs on a nearly level plain which consists of slight rises and shallow dips which differ only 3 feet or less in relief. The Beadle soils occur on the slight rises and the Cresbard soils occupy the shallow dips. There is a scattering of stones on and in the soils.

This complex is fertile and has fair to good tilth. It is not subject to water erosion and is subject to blowing only during periods of prolonged drought. This unit is a poor prospect for irrigation principally because of the slow permeability of the parent materials.

Use and Management. This complex is used principally for the production of small grains, for hayland, and for pasture. Corn is fairly well adapted. Management practices are similar to those for unit No. 6. This soil is in Management Group 4 for crop yield predictions.

No. 14 Beadle-Houdek-Cresbard Silt Loams, Nearly Level (0-2%)

This complex consists of three nearly level soils developed in glacial till. The Beadle has a firm subsoil while the Houdek and Cresbard soils have friable subsoils. The Houdek soil has a thinner profile than the Cresbard. The complex is composed of about 50 percent Beadle, 30 percent Houdek, and 20 percent Cresbard. For descriptions and diagrams of the profiles see unit No. 6 for Beadle, unit No. 67 for Houdek, and unit No. 33 for Cresbard.

This complex is of limited extent and occurs in southeast Spink County. This complex occurs on nearly level areas which consist of slight rises, flats, and shallow swales. The Beadle and Houdek soils occur on the rises, and flats while the Cresbard soil occupies the shallow swales. A scattering of stones occurs on and in the soils.

This complex is fertile and has fair to good tilth. It is not subject to water erosion and is subject to wind erosion only during periods of prolonged drought. This unit is a poor prospect for irrigation.

Use and Management. This complex is used and managed the same as unit No. 13. It is in Management Group 4 for crop yield predictions.

No. 15 Beotia Silt Loam, Level (0-1%)

This is a well-drained, friable soil occurring on level positions near streams on the Glacial Lake Dakota Plain (Soil Area A, Fig. 3). The soil is of extensive occurrence over all of the Lake Bed area and although the terrain is level and measures 1 percent or less in slope, it has a slight surface gradient. The soil occupies what might be called levee positions formed by overflow of a stream and thus its occurrence is in long strips of variable width paralleling the stream channels. The parent material of this soil is lake-laid silts. The soil profile is permeable, yet has good water holding capacity. There are occasionally slight concentrations of salts and alkali in the parent material. There are no stones in or on the soil. A profile diagram and description are shown in Fig. 9.

Beotia silt loam level, is a fertile soil of good tilth. It is not subject to water erosion and is subject to wind erosion only during periods of prolonged drought. This soil is an excellent prospect for irrigation if drainage through the parent material is adequate.

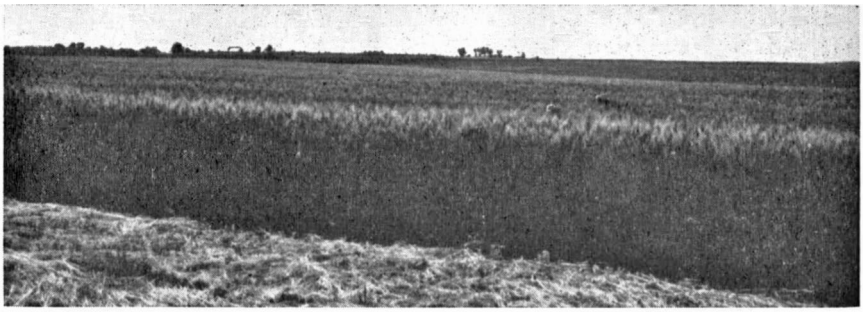
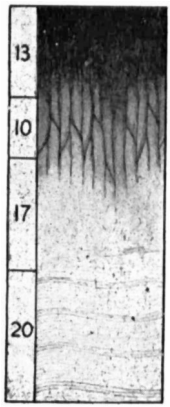


Photo by C. A. Mogen, SCS

Landscape of Beotia silt loam. The Beotia soil occupies the nearly level area in the foreground. In the background the Great Bend soils occur on the slightly sloping terrain. Beotia and Great Bend are used primarily for spring wheat.

Fig. 9. Beotia silt loam



A_1 0-13″ Black, friable silt loam of granular structure

B_2 13-23″ Very dark grayish-brown grading to olive brown, friable silt loam of prismatic structure

C_{ca} 23-40″ Yellowish-brown, friable silt loam, highly calcareous, sometimes slightly saline

C 40-60″ Light yellowish-brown, friable silt loam, calcareous, sometimes slightly saline

Use and Management. This soil is used primarily as cropland and good yields are obtained. Small grains and corn are adapted crops. This soil is considered one of the best in the county and can be kept at a high level of productivity by maintaining available nitrogen either by inclusion of a legume in the rotation or by using commercial nitrogen fertilizer. This soil is in Management Group 3 for crop yield predictions.

No. 16 Beotia Silt Loam, Moderately Saline Substratum, Level (0-1%)

This soil differs from unit No. 15 in two respects: the substratum (parent material) of this soil is usually moderately saline while the substratum of unit No. 15 is occasionally slightly saline; and the subsoil (B horizon) of this soil is finer textured than unit No. 15 being usually a light silty clay loam, while the subsoil of unit No. 15 is a silt loam. Although their general

landscape position is the same, this soil is located farther back from the stream valleys than is unit No. 15 and hence is not quite as well-drained. This is an extensive soil over all of the Glacial Lake Dakota Plain. Except for the variations noted this soil is similar in its other characteristics to unit No. 16.

This is a fertile soil of good tilth. It is not subject to water erosion and is subject to blowing only during prolonged drought. It is a good prospect for irrigation if substratum drainage is adequate.

Use and Management. This soil is used and managed like unit No. 15. This soil is in Management Group 3 for crop yield predictions.

No. 17 Beotia Silt Loam, Till Substratum, Level (0-1%)

This soil is of rather limited extent, being confined in Spink County to the eastern border of the Lake Dakota Plain where the lake-laid sediments are 36-60 inches thick overlying the glacial till. The presence of the till substratum sets this soil out from unit No. 15 and it generally has the same qualities except that the presence of the glacial till substratum reduces the irrigation potential of this soil to a grade of fair for gravity irrigation.

Use and Management. This soil resembles unit No. 15 in its use and management. It is in Management Group 3 for crop yield predictions.

No. 18 Beotia Silt Loam, Nearly Level (2-3%)

This soil differs from unit No. 15 by occurring on nearly level rather than level terrain. This soil is of limited extent and occurs on very gentle slopes near stream valleys on the Glacial Lake Dakota Plain. It is similar in soil profile characteristics and qualities to unit No. 15. It is an excellent prospect for irrigation. This soil is subject to slight water erosion.

Use and Management. This soil resembles unit No. 15 in use and management except that some emphasis should be placed on close growing crops for control of water erosion. This soil is in Management Group 3 for crop yield predictions.

No. 19 Beotia Silt Loam, Moderately Saline Substratum, Nearly Level (2-3%)

This soil is of rather limited extent and occurs on very gentle slopes near stream valleys on the Glacial Lake Dakota Plain. It differs from unit No. 15 in two respects: the substratum is moderately saline; and it occurs on nearly level slopes while unit No. 15 occurs on level topography. It resembles unit No. 15 in soil characteristics and qualities except that it is a good rather than excellent prospect for irrigation. This soil is subject to slight water erosion.

Use and Management. This unit is used the same as unit No. 15 and is managed the same except that some emphasis should be placed on close growing crops for control of water erosion. This soil is in Management Group 3 for crop yield predictions.

No. 20 Beotia Silt Loam, Till Substratum, Nearly Level (2-3%)

This soil differs from unit No. 15 in two respects: by the presence of a glacial till substratum from 36 to 60 inches, and by being nearly level rather than level. This soil is of limited extent and occurs on very gentle slopes near stream valleys on the eastern border of the Glacial Lake Dakota Plain. In soil characteristics and qualities it resembles unit No. 15 except that the presence of glacial till substratum makes this soil only a fair prospect for gravity irrigation. This soil is subject to slight water erosion.

Use and Management. This soil resembles unit No. 15 in use and management except that close growing crops should be included in cropping sequences to control water erosion. This soil is in Management Group 3 for crop yield predictions.

No. 21 Beotia Silt Loam, Gently Sloping (4-5%)

This soil is of very limited extent and occurs on gentle slopes near stream valleys on the Glacial Lake Dakota Plain. It differs from unit No. 15 by occuring on gentle slopes rather than on level topography. This soil resembles unit No. 15 in soil characteristics and qualities except that it is only a fair prospect for gravity irrigation, and it is subject to from slight to moderate water erosion.

Use and Management. Beotia silt loam, gently sloping, is used and managed the same way as unit No. 15. Contour tillage may be found necessary to control runoff. This soil is in Management Group 10.

No. 22 Beotia Silt Loam, Valley Phase, Nearly Level (0-2%)

This soil has developed in sediments accumulated at the foot of the slope where they originated. It is of very limited extent in Spink County and occurs near the major streams on the Lake Dakota Plain. This soil resembles unit No. 15 in soil profile characteristics except that the surface horizon is thicker. It resembles unit No. 15 in soil qualities except that it is only a good prospect for irrigation, and there is a tendancy for gullies to form because surface drainage from higher lying areas flows across the unit.

Use and Management. This soil is used and managed like unit No. 15 except that grassed waterways may be necessary to control gully erosion where it threatens. This soil is in Management Group 3.

Landscape of Bonilla-Houdek silt loams. Both soils are developed in glacial till with the Bonilla soils occurring on nearly level positions and the Houdek soils occurring on the gentle rises. Both soils are used for corn and small grains.

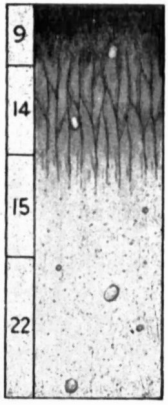
No. 23 Bonilla-Houdek Loams, Nearly Level (0-2%)

This complex consists mainly of two nearly level soils, the Bonilla with a soil profile thickness of about 23 inches, and the Houdek with a thickness of profile of about 15 inches. The parent material of both soils is friable, loam textured glacial till. The complex is composed of about 65 percent Bonilla, 25 percent Houdek, and 10 percent Cresbard. The Bonilla soil profile is described and shown in Fig. 10. The Houdek is described under unit No. 67, and the Cresbard under unit No. 33. This complex occurs extensively in western Spink County in Soil Area B, Fig. 3.

This complex occurs on a nearly level plain which consists of a series of low, round-topped rises separated by flats and slightly concave areas and a few shallow swales. The Bonilla soils are found on the flats and slightly concave areas, the Houdek soils on the slight rises, and the Cresbard soils in the shallow swales. The landscape is further characterized by the presence of sloughs usually large enough to separate out as the Tetonka soils which are described in unit No. 103. The glacial till parent material is only slowly permeable and salts and alkali are present in it in slight to moderate amounts. A scattering of stones occurs on and in the soil.

This complex is generally fertile and has good tilth. It is slightly subject to water erosion on the low rises occupied by the Houdek soils. It is slightly subject to blowing especially during periods of prolonged drought. It is only a fair prospect for irrigation due principally to the slow permeability of the glacial till and to the irregular surface relief.

Fig. 10. Bonilla silt loam



A_1 0-9″ Black, friable silt loam of granular or prismatic structure

B_2 9-23″ Dark brown, friable loam of prismatic or blocky structure

C_{ca} 23-38″ Light olive brown, friable loam, highly calcareous, usually slightly to moderately saline

C 38-60″ Light olive brown, friable, loam glacial till, moderately calcareous, usually slightly to moderately saline

Use and Management. Bonilla-Houdek loams, nearly level, complex is used principally as cropland and good yields are obtained if moisture relations are favorable. Small grains and corn are raised and a few areas are in pasture and hayland. The principal management problem consists of maintaining available nitrogen which can be done by using a legume in the rotation or by using commercial nitrogen fertilizers. This complex is in Management Group 3 for crop yield predictions.

No. 24 Bonilla-Houdek Silt Loams, Nearly Level (0-2%)

This complex is the same as unit No. 23 except that all included soils are silt loams rather than loams. The effect of this difference in texture is that this unit is not subject to blowing except during prolonged drought while unit No. 23 is subject to slight wind erosion. This complex is of fairly limited extent and occurs in eastern Spink County. In soil qualities, other than those mentioned above, this unit resembles unit No. 23. This complex is a fair prospect for irrigation.

Use and Management. This unit is used and managed like unit No. 23. It is in Management Group 3 for crop yield predictions.

No. 25 Bonilla-Cresbard Silt Loams, Nearly Level (0-2%)

This complex consists of two nearly level soils developed in friable, loam textured glacial till. The complex is composed of about 60 percent Bonilla and 40 percent Cresbard. The Bonilla is described in unit No. 23 while Cresbard is described in unit No. 33. This complex is of limited extent and occurs in western Spink County on nearly level areas which consist of flats and shallow swales. The flats are the sites for Bonilla soils and

the Cresbard soils occur in the shallow swales. The glacial till parent material is only slowly permeable. Salts and alkali are usually present in the substratum of the Bonilla but are rarely found in the substratum of the Cresbard. A scattering of stones occurs on and in the soils.

This complex is fertile and has good tilth. It is not subject to water erosion and suffers from wind erosion only during years of prolonged drought. This complex is a fair prospect for irrigation.

Use and Management. This complex is used and managed like unit No. 23. It is in Management Group 3 for crop yield predictions.

No. 26 Bonilla-Houdek Fine Sandy Loams, Nearly Level (0-2%)

This complex has the same composition as Unit No. 23 but differs from it in that all included soils have fine sandy loam surface soils. This unit is of limited extent and occurs in southwestern Spink County within or near Soil Area C, Fig. 3. This unit was formed largely as a result of soil blowing. Fine sand material blew off the outwash plain and was deposited like a blanket over a nearly level till plain. The thickness of this fine sandy loam surface soil varies from about 8 to 12 inches. This soil has a high water intake rate. Because of the fine sandy loam surface it also has good water-holding capacity due to the finer textured subsoil. The underlying glacial till is only slowly permeable and may contain moderate amounts of salts and alkali.

This complex is moderately fertile and has good tilth. It is quite susceptible to blowing but is not subject to water erosion. This complex is a good to fair irrigation prospect.

Use and Management. This complex is used for the production of corn and small grain both of which do well. The principal management problems concern the control of wind erosion and the maintenance of fertility. Planting alternate strips of open tilled and close growing crops, planting at right angles to the prevailing wind, and leaving the soil in a cloddy condition will all tend to stabilize these soils. Fertility, especially nitrogen, can be maintained by growing legumes or using commercial nitrogen fertilizers or barnyard manure. This soil is in Management Group 2 for crop yield predictions.

No. 27 Bonilla-Houdek Fine Sandy Loams, Firm Till Substratum Nearly Level (0-2%)

This complex is similiar to unit No. 26 described above except that the till substratum is a firm clay loam rather than a friable loam. This affects the irrigation potential of this soil by lowering it to poor for gravity irrigation. This soil is of very limited extent and occurs in the eastern part of the county. The other soil characteristics and qualities of this soil are similar to those of unit No. 26.

Use and Management. This soil is used and managed like unit No. 26. This soil is in Management Group 2 for crop yield predictions.

No. 28 Bonilla-Groveland Fine Sandy Loams, Nearly Level (0-2%)

This complex is of very limited extent occurring in the western part of the county northwest of Redfield. It consists of the Bonilla soils which have fine sandy loam surface soils but a subsoil and substratum developed in loam till, and the Groveland soils developed in stratified loam and fine sand. The complex is composed of about 60 percent Bonilla and 40 percent Groveland. The Bonilla profile is described in unit No. 23 and the Groveland profile is described in Fig. 11.

This complex occurs on nearly level, small, low-lying plains in an undulating to rolling landscape. The two soils occur intimately together and neither one has a characteristic position on the plain. Because of the association with the stratified Groveland, the entire Bonilla profile including the parent material contains more sand than the normal type of Bonilla. For this reason permeability of both members of this complex is fair and no harmful salts or alkali occur within 5 feet of the surface. This complex is not droughty. A scattering of stones may occur on and in the soil.

This complex is fertile and has good tilth. It is not subject to water erosion but is susceptible to blowing. It is a good prospect for irrigation.

Fig. 11. Groveland fine sandy loam

A_1 0-5″ Very dark brown, friable fine sandy loam of granular structure

B_2 5-17″ Brown, friable fine sandy loam or loam, of weak prismatic structure

C_{ca} 17-34″ Light olive brown, stratified fine sandy loam, fine sand loam, and silt loam, with some gravel and sand, strongly calcareous

C 34-60″ Same as above horizon except moderately calcareous

Use and Management. This soil is used principally for cropland and good yields are obtained. Corn and small grains are both adapted. Management needs to provide for protection against blowing and this may be done by utilizing alternate strips of small grain, row crops, and grass legume mixtures at right angles to the prevailing wind. It should never be left bare. This soil is in Management Group 2 for crop yield predictions.

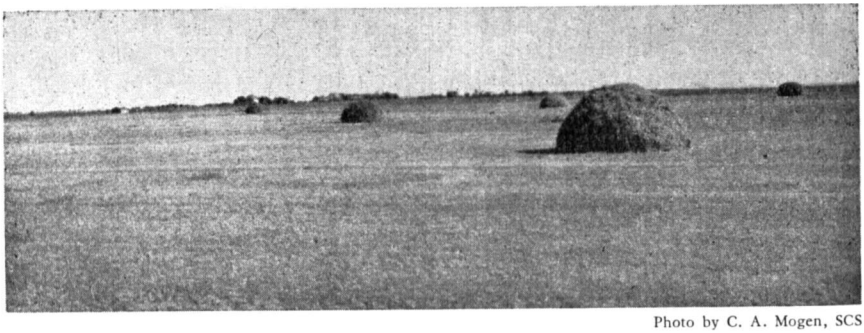


Photo by C. A. Mogen, SCS

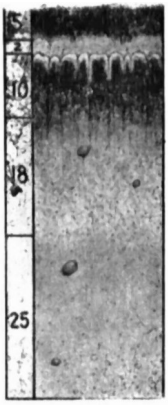
Landscape and land use pattern for Cavour-Beadle silt loams. Most of the hay grown on this soil complex is native grass hay.

No. 29 Cavour-Beadle Silt Loams, Nearly Level (0-2%)

This complex consists of two nearly level soils developed in firm clay loam glacial till. The Cavour soils have compact claypans while the subsoil in the Beadle soils is firm. This complex is of very limited extent and is found in eastern Spink County. The complex is composed of about 60 percent Cavour and 40 percent Beadle. The Cavour soil is described in Fig. 12 and the Beadle soil is described in unit No. 6. This complex occurs on nearly level areas which consist of a low-lying plain interrupted by gentle rises. The Cavour soils occupy the low-lying plain and the Beadle soils the slight rises in this landscape. The substrata of both of these soils are only slowly permeable as is the subsoil of the Cavour. The substrata of both soils are saline. A scattering of stones occurs in and on the soils of this complex.

This complex is moderately fertile and has fair tilth. It is not subject to either wind or water erosion. It is a poor prospect for irrigation.

Fig. 12. Cavour silt loam



A_1 0-5″ Black, friable silt loam of weak platy structure

A_2 5-7″ Gray, friable silt loam of platy structure

B_2 7-17″ Black, compact clay loam of columnar structure, splotched with salt in lower part

C_{ca} 17-35″ Light olive brown clay loam or loam, highly calcareous, moderately or highly saline

C35-60″ Olive brown, clay loam or loam glacial till, moderately calcareous, moderately or highly saline

Use and Management. This complex is used principally as native grass pasture and hayland although a limited acreage is used for crop production. Problems of management when complex is used as cropland include wetness during the planting season and maintenance of tilth and a supply of available nitrogen. These limitations are difficult to overcome in years of more than average moisture because of the depressional position of the Cavour soil. These problems are not as serious when the soil is used for hayland or pasture. This soil is in Management Group 6 for crop yield predictions.

No. 30 Cavour-Houdek Silt Loams, Nearly Level (0-2%)

This complex is of limited extent and is found in western Spink County in Soil Area B, Fig. 3. It consists of two nearly level soils developed in friable, loamy glacial till. The Cavour soils have compact subsoils while the subsoils of the Houdek soils are friable. The complex is composed of about 60 percent Cavour and 40 percent Houdek. The Cavour soils are described in unit No. 29 and the Houdek soils in unit No. 67. This complex occurs on a landscape which consists of gentle rises on a low-lying plain. The Houdek soils occupy the gentle rises. Both soils have saline substrata which are only slowly permeable. A scattering of stones occurs on and in the soils of this complex.

This complex is moderately fertile and has fair tilth. It is not subject to either water or wind erosion. It is a poor prospect for irrigation.

Use and Management. This complex is used and managed like unit No. 29. This complex is in Management Group 6 for crop yield predictions.

No. 31 Cavour Thin Surface-Tetonka Complex, Nearly Level (0-2%)

This complex consists of two depressional soils, the Cavour having a thin surface soil and a compact subsoil, and Tetonka, a poorly drained soil. This complex is of fairly wide extent and occurs principally on the west side of Spink County. The complex is composed of about 70 percent Cavour and 30 percent Tetonka. For descriptions and diagrams of the profiles see unit No. 29 for Cavour and unit No. 103 for Tetonka. This complex occurs in shallow, flat-bottomed depressions in the till plain. Usually the Tetonka occupies the wet, central portion of the depression with the Cavour occurring around it as a ring. Although the substrata of both of these soils are glacial till, the upper parts of the profiles are developed in materials washed down from nearby areas. The Cavour soil is saline immediately below the subsoil while the Tetonka soils are usually nonsaline to depths of 4 to 5 feet.

This complex is infertile and tilth is poor because the compact subsoil is usually brought to the surface by tillage. It is not subject to water erosion or blowing. This complex is not suited for irrigation.

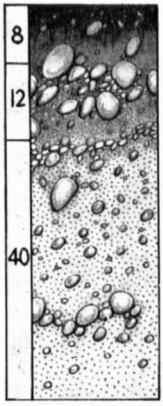
Use and Management. This complex is used for pasture and hayland. Where composition and quality of the stand is poor, areas may need reseeding with crested wheatgrass or western wheatgrass. Grazing should be controlled so that at least 2 inches of cover remains at all times. This complex is in Management Group 7 for yield predictions.

No. 32 Crandon-Houdek Loams, Hilly (10-15%)

This complex consists principally of two hilly soils, the Crandon from gravelly outwash and the Houdek from glacial till. The Crandon profile is described below, while the Houdek soil is described in unit No. 67. This complex occurs on hilly areas which consist of a series of round-topped, steep-sided hills interspersed with areas of gentler slopes and swales with a few prominent sloughs. Local relief differences are from 20 to 50 feet or more. The Crandon soils occupy the steeper slopes in this terrain with the Houdek loam occurring on the gentler slopes with Tetonka silt loam (described in unit No. 103) being found in the swales and sloughs. The approximate percentage composition of the complex is: Crandon 55 percent, Houdek 35 percent, and Tetonka 10 percent. This unit is of limited extent in Spink County. Stones and boulders commonly occur on the Crandon. A profile diagram and description for the Crandon soil is given in Fig. 13.

The Crandon-Houdek complex has low productivity, is subject to high rates of runoff, and erodes when cultivated. It is unsuited for irrigation.

Fig. 13. Crandon gravelly loam



A_1 0-8″ Very Dark grayish-brown, friable gravelly loam of weak granular structure

D_{ca} 8-20″ Brown gravelly loamy sand with lime crust on the gravel

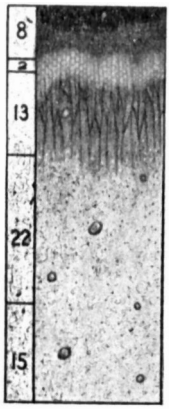
D 20-60″ Brown gravelly loamy sand, calcareous

Use and Management. This complex is used for pasture and where the slope is not excessive, for hayland. Where so used the composition and quality of the stand can be improved by reseeding with mixtures of grasses and legumes and by controlled grazing. This complex is in Management Group 16 for livestock stocking rates.

No. 33 Cresbard-Beadle Silt Loams, Nearly Level (0-2%)

This complex is quite limited in extent and occurs in eastern Spink County. It consists of two nearly level soils developed in firm glacial till of clay loam texture. The Cresbard occurs in slight dips, has a gray layer, and a friable subsoil. The Beadle occurs on flats and has a firm subsoil. The complex is composed of about 70 percent Cresbard and 30 percent Beadle. The Cresbard description and diagram is shown below while the Beadle is described in unit No. 6. Although the Cresbard soils are usually nonsaline to depths of 5 feet, the Beadle soil ordinarily is slightly saline below the subsoil. The parent material of both soils is only slowly permeable. A scattering of stones may occur in and on the soil. A profile description and diagram of Cresbard are shown in Fig. 14.

Fig. 14. Cresbard silt loam



A_1 0-8″ Black, friable silt loam of granular structure

A_2 8-10″ Light gray (dry), friable silt loam of blocky structure

B_2 10-23″ Dark gray, friable clay loam of prismatic structure, grading into brown soil in lower part

C_{ca} 23-45″ Yellowish-brown, friable or firm loam or clay loam, strongly calcareous in upper part

C 45-60″ Yellowish-brown, friable or firm, loam or clay loam glacial till

This complex is fertile and has good tilth. It is not subject to either wind or water erosion. It is however, a poor prospect for irrigation because of low permeability of the substrata and the minor irregularities of the slope.

Use and Management. This complex is used principally as cropland. The principal problem of management is the fact that the two members of the complex are usually not ready to work at the same time. When these areas are used for hay and pasture this problem does not arise. This complex is in Management Group 4 for crop yield predictions.

No. 34 Cresbard-Bonilla Silt Loam, Nearly Level (0-2%)

This complex is limited in extent and occurs in western Spink County. It consists of two nearly level soils developed in friable loamy glacial till. The Cresbard occurs in shallow dips or swales, has a gray layer, and a friable subsoil. The Bonilla occurs on gentle rises, on flats, or in slightly concave positions and has a friable subsoil. The complex is composed of about 70 percent Cresbard and 30 percent Bonilla. For diagrams and descriptions of the profiles see unit No. 33 for Cresbard and unit No. 23 for Bonilla. The Cresbard soil is usually nonsaline to depths of 5 feet while the Bonilla soils ordinarily are slightly to moderately saline below the subsoil. The parent material of both soils is only slowly permeable. A scattering of stones may occur in and on the soil.

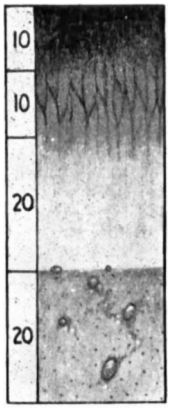
This complex is fertile and has good tilth. It is not subject to water or wind erosion. It is a poor prospect for irrigation because of the slow permeability of the substrata and the minor irregularities of the slope.

Use and management. This complex is used and managed the same as unit No. 33. It is in Management Group 3 for crop yield predictions.

No. 35 Doland Silt Loam, Nearly Level (0-2%)

This is a well-drained, friable, silt loam soil occurring on nearly level and very gently sloping positions in eastern Spink County. This soil is of fairly limited extent and occurs in a belt about 2 to 4 miles wide adjacent to the Lake Dakota Plain between Doland and Conde and north to the Brown County line. The parent material for this soil is loess which mantles these areas to a thickness of 3 to 4 feet. Underlying the loess is a firm, clay

Fig. 15. Doland silt loam



A_1 0-10″ Black, friable silt loam of granular structure

B_2 10-20″ Dark grayish-brown, friable silt loam of prismatic structure

C_{ca} 20-40″ Light yellowish-brown, friable, silt loam loess, highly calcareous

D-40-60″ Dark grayish-brown, firm, clay loam glacial till, moderately calcareous, usually slightly saline

loam glacial till. The soil profile is permeable and free of salts, while the glacial till substratum is only slowly permeable and usually slightly saline. There are no stones present. A soil profile is described and shown in Fig. 15.

Doland silt loam, nearly level, is a fertile soil of good tilth. It is only slightly subject to wind and water erosion. It is an excellent prospect for sprinkler irrigation and a good prospect for gravity irrigation.

Use and Management. This soil is used mainly as cropland and good yields are obtained. This soil is considered one of the best in the county and can be kept at a high level of fertility by maintaining a source of available nitrogen either by use of a legume in the rotation or by using commercial nitrogen fertilizer or manure. This soil is in Management Group 3 for crop yield predictions.

No. 36 Doland Silt Loam, Loamy Fine Sand Substratum, Gently Sloping (3-5%)

This soil is similar in profile characteristics to unit No. 35 but differs from it by having a loamy fine sand rather than a glacial till substratum. This soil is of limited extent and is found where the Doland soil area slopes down gently to the Glacial Lake Dakota Plain. The fine sand substratum may have been a beach of the glacial lake which was later covered by silts which blew off the Lake Bed before it was stabilized by vegetation. The fine sand substratum occurs at about 30 to 40 inches from the soil surface. This soil profile and substratum are both permeable and both free of salts and alkali. There are no stones present. See unit No. 35 for a description of the Doland soil profile.

This soil is fertile and has good tilth. It is slightly subject to water erosion but is not subject to wind erosion except during periods of prolonged drought. It is an excellent prospect for sprinkler irrigation.

Use and Management. This soil is used and managed the same as unit No. 35. It is in Management Group 3 for crop yield predictions.

No. 37 Doland Silt Loam-Solonetz Complex, Nearly Level (0-2%)

This complex consists of two nearly level soils, the Doland which is a friable soil, and the soil here referred to as a Solonetz. Solonetz is a soil term used to describe claypan soils which have formed due to the puddling action of sodium salts on soil clay. When Solonetz soils are of extensive occurrence in an area they are named like other soils; however, in this case the Solonetz is limited in extent and the soil is simply called Solonetz. The parent material of both soils of this complex is a silt loam loess with substrata of firm, clay loam glacial till. The composition of the complex is about 70 percent Doland and 30 percent Solonetz. The Doland profile is pictured

and described in unit No. 35. The Solonetz profile consists of a black, friable, silt loam surface soil about 8 inches thick and a dark gray, compact subsoil about 12 inches thick.

This complex is very limited in extent and occurs in the Doland soil area northeast of the town of Doland. The complex occurs on a nearly level plain consisting of a series of low, round-topped rises separated by shallow swales. The Doland soil occurs on the rises and the Solonetz occupies the swales. The glacial till substratum of both soils is only slowly permeable as is the subsoil of the Solonetz. Salts and alkali occur in slight concentrations in the substrata of both soils. No stones are present on or in the soil profiles.

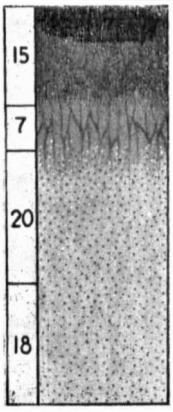
This complex is fertile and has good tilth generally except that the Solonetz may have poor tilth if worked when wet. It is not subject to water erosion or blowing. This complex is only a fair prospect for irrigation because of the slow permeability of the substratum and because of the presence of slowly permeable subsoil in the Solonetz part of the complex.

Use and Management. This complex is used more for pasture and hay than unit No. 35, although it resembles it generally in use and management. The shallow swales where the Solonetz occurs may be wet in the spring when the associated Doland soil is ready to work. This complex is in Management Group 3 for crop yield predictions.

No. 38 Eckman Loam, Nearly Level (2-3%)

This is a well-drained, friable soil occurring on nearly level or very gently sloping positions near stream valleys scattered over the Glacial Lake Dakota Plain (Fig. 3). The total acreage in the county is rather small and most of it occurs in the north central part of the Lake Bed in rather small patches. The parent material is loam and fine sandy loam

Fig. 16. Eckman loam



A_1 0-15″ Black, friable loam of granular structure

B_2 15-22″ Very dark grayish-brown, friable loam of prismatic structure

C_{ca} 22-42″ Light yellowish-brown, friable fine sandy loam to loamy very fine sand, strongly calcareous

C 42-60″ Light yellowish-brown, friable fine sandy loam to loamy very fine sand, moderately calcareous

water-laid sediments which have been reworked some by wind. This soil and its substratum are permeable yet both have good water holding capacity. No salts or alkali are present in either the soil or substratum. There are no stones present. The soil profile is pictured and described in Fig. 16.

This soil is fertile and has good tilth. It is slightly susceptible to wind and water erosion. It is an excellent prospect for irrigation.

Use and Management. This soil is used principally for cropland and good yields are obtained. It is an excellent corn and alfalfa soil and a good small grain soil. Maintenance of a supply of available nitrogen is the principal management problem and this can be done by use of a legume in the rotation or by using commercial nitrogen fertilizer or manure. This soil is in Management Group 3 for crop yield predictions.

No. 39 Eckman Loam, Level (0-1%)

This soil is the same as unit No. 38 except that it occurs on level rather than nearly level terrain. It is of limited extent in Spink County and occurs on the Glacial Lake Dakota Plain near or on the break from the Lake Bed Plain to a stream bottom.

Like unit No. 38 this soil is fertile and has good tilth. It is slightly susceptible to wind erosion but is not subject to water erosion. It is an excellent prospect for irrigation.

Use and Management. This soil is used and managed like unit No. 38. It is in Management Group 3 for crop yield predictions.

No. 40 Eckman Loam, Gently Sloping (4-5%)

This soil resembles unit No. 38 except that it occurs on gently sloping rather than nearly level areas. It occurs on sandier areas of the Glacial Lake Dakota Plain where the Lake Bed slopes to a stream bottom. It is of limited extent in the county.

This soil is fertile and has good tilth. It is slightly susceptible to wind erosion and moderately subject to water erosion although the loamy nature of surface soil encourages rapid rainfall absorption. It is an excellent prospect for sprinkler irrigation and a good prospect for gravity irrigation.

Use and Management. This soil is used like unit No. 38. Because of its sloping nature it may require contour tillage as a water erosion control measure. It is in Management Group 10 for crop yield predictions.

No. 41 Eckman Loam, Sloping (6-9%)

This soil is similar to unit No. 38 except that it occurs on sloping rather than nearly level landscape positions. It is of very limited extent in Spink County and is found on the Glacial Lake Dakota Plain where the

Lake Bed slopes to a stream bottom. The profile of this soil is generally a little thinner than is the profile of unit No. 38.

This soil is fertile and has good tilth. A water erosion problem exists on this soil when it is cultivated, and due to its loamy surface soil it is slightly susceptible to blowing. The sloping nature of this soil makes it only a fair prospect for sprinkler irrigation.

Use and Management. This soil is used for cropland, pasture, and hayland. When this soil is cropped, terraces and contour tillage are necessary to control erosion. This soil is in Management Group 10 for crop yield predictions.

No. 42 Eckman Loam, Valley Phase, Nearly Level (0-2%)

This soil resembles unit No. 38 except that it occurs on valley phase positions in the Lake Bed rather than on nearly level sites on the Glacial Lake Dakota Plain. Valley phase positions are those between a slope and the flood plain of a stream. The soil occurs in long, narrow, irregular bands and is of limited extent in the county.

This soil is fertile and has good tilth. It is slightly susceptible to blowing. Gullies tend to form in this soil because of drainage from steeper slopes above. This soil is an excellent prospect for sprinkler irrigation and a good prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 38. Grassing of the drainageways which cross this soil may be necessary to control gullies. This soil is in Management Group 3 for crop yield predictions.

No. 43 Eckman Fine Sandy Loam, Nearly Level (0-2%)

This well-drained soil is developed in fine sandy loam alluvium on smooth terraces along the James River and larger creeks. It is of very limited extent in Spink County. It resembles unit No. 38 in soil profile characteristics except that it has a fine sandy loam rather than a loam surface soil.

This soil is fertile and has good tilth. It is not subject to water erosion but is moderately subject to blowing. It is an excellent prospect for irrigation.

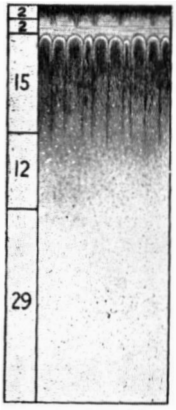
Use and Management. This soil is used and managed like unit No. 38. If fall tillage is used the soil should be left in a lumpy condition to control blowing. In dry years cross directional strips of close growing crops with intertilled crops may be necessary to control wind erosion. This soil is in Management Group 2 for crop yield predictions.

No. 44 Exline Complex, Level (0-1%)

This complex consists dominantly of imperfectly drained claypan soils with very thin surfaces occurring on level low lying positions on the Glacial Lake Dakota Plain or on broad stream bottoms. This soil is of extensive occurrence in Spink County. The parent material is clayey alluvium. Although the surface of this complex appears level it actually consists of a series of mounds and swales or pits with elevation differences of a foot or less between them. This type of relief is called microrelief.

The Exline soil makes up over 85 percent of the complex. The remaining 15 percent of this complex is composed of imperfectly and poorly drained alluvial soils of the Lamoure series which is described in unit No. 92. This complex is very slowly permeable and usually has high concentrations of salts and alkali in the soil parent materials. The Exline soil is described and pictured in Fig. 17.

Fig. 17. Exline silty clay loam



A_1 0-2″ Very dark gray, friable silt loam of granular structure
A_2 2-4″ Gray, friable silt loam of platy structure
B_2 4-19″ Black, compact silty clay, structure consists of strongly developed round-topped columns; salt accumulation starts in lower part

C_{ca} 19-31″ Light olive gray silty clay, strongly calcareous, usually strongly saline

C 31-60″ Light gray silty clay or silty clay loam, moderately calcareous, usually strongly saline

This soil is usually infertile and has very poor tilth. It is not subject to either water or wind erosion. It is unsuited for irrigation.

Use and Management. This soil is used mainly for native grass pasture and hay. Successful cultivation of this soil involves overcoming many problems; the soil is usually wet in the spring, the compact claypan is poorly aerated, and in addition restricts root and moisture penetration, and plowing usually incorporates some of the puddled subsoil into the plow layer. Fall sown, rather than spring sown grains are better adapted to this soil. This is because the soil is dry enough to work in early fall while it is usually so wet in the spring that seeding is delayed. However, good crops of spring sown grain have been observed on this soil following several years of a legume which was plowed under the preceding fall before all

available moisture was removed from the soil. The legume improved the tilth of the soil, supplied the soil with a source of available nitrogen, and removed some excess water. This soil is in Management Group 7 for crop yield predictions.

No. 45 Exline Complex, Nearly Level (2-3%)

This complex is similar to unit No. 44 except that it occurs on nearly level rather than on level landscapes. Like unit No. 44 it occurs on low lying positions on the Glacial Lake Dakota Plain and on broad stream bottoms but the relief of this unit is more pronounced.

This soil is usually infertile and has very poor tilth. It is not subject to either wind or water erosion. It is not suited for irrigation.

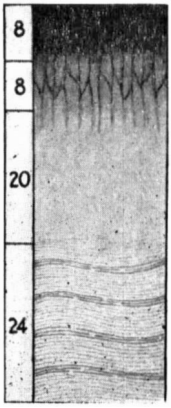
Use and Management. This soil is used and managed like unit No. 44. This soil is in Management Group 7 for yield predictions.

No. 46 Great Bend Silt Loam, Gently Sloping (4-5%)

This is a well-drained, friable, silty soil occurring extensively in Spink County on gently sloping positions over all of the Glacial Lake Dakota Plain. These positions are the relatively long, smooth slopes from the table-like Lake Bed Plain to a stream bottom. The parent material is lake-laid silts. The Great Bend soils have thinner solums (A and B horizons together) than do the Beotia soils which are developed in similar material, and they have thicker solumns than the associated Zell soils. This soil is usually permeable and may have slightly to moderately saline parent material. There are no stones present. A profile is pictured and described in Fig. 18.

This is a fertile soil of good tilth. It is moderately subject to water erosion but is not subject to blowing. This soil is a good prospect for sprinkler irrigation.

Fig. 18. Great Bend silt loam



A_1 0-8″ Very dark gray, friable silt loam of granular structure

B_2 8-16″ Very dark-grayish brown, friable silt loam of prismatic structure

C_{ca} 16-36″ Light olive brown, friable silt loam, strongly calcareous, may be slightly to moderately saline

C 36-60″ Light olive brown, laminated silt loam, calcareous, may be slightly to moderately saline

Photo by C. A. Mogen, SCS

An area on the Lake Dakota Plain where the level lake bed is sloping toward a drain. These sloping positions are occupied by Great Bend silt loam.

Use and Management. This soil is used largely for cropland and good yields of small grains and corn are obtained when climate is favorable. Good tilth is necessary so that the soil can absorb all the rainfall which falls on it. The slopes of this soil are smooth and long. This type of slope adapts itself to contour tillage and also to terraces. Both of these practices may be necessary to control runoff. Fertility may be maintained in this soil by use of legumes in rotation, by commercial nitrogen fertilizer, or by manure. Legumes will aid in maintaining good tilth. This soil is in Management Group 10 for crop yield predictions.

No. 47 Great Bend Silt Loam, Nearly Level (2-3%)

This soil differs from unit No. 46 by occurring on nearly level rather than gently sloping positions. This soil is of rather limited extent and occurs mostly in the southern part of the Glacial Lake Dakota Plain (Fig. 3) where the Lake Bed is dissected by a number of shallow channels which were occupied by streams during the final stage of Glacial Lake Dakota. The very gentle slopes are smooth but rather short. In soil characteristics other than slope this soil resembles unit No. 46.

This soil is fertile and has good tilth. It is slightly subject to water erosion but is not subject to drifting. This soil is an excellent prospect for sprinkler irrigation.

Use and Management. This soil is used and managed like unit No. 46 except that control of runoff is usually not a serious problem. This soil is in Management Group 3 for crop yield predictions.

No. 48 Great Bend Silt Loam, Level (0-1%)

This soil differs from unit No. 46 by occurring on level rather than gently sloping positions. It is of limited extent and occurs principally in the

southern part of the Glacial Lake Dakota Plain (Fig. 3) and occupies the stream divide positions where the Lake Bed is dissected by numerous stream channels. These positions are flat but are quite narrow so that some runoff has always taken place. This has resulted in a relatively thin soil being developed on level topography. In soil characteristics other than slope this soil resembles unit No. 46.

This soil is fertile and has good tilth. It is slightly subject to water erosion but is not subject to drifting. It is an excellent prospect for irrigation where it occurs as a large area.

Use and Management. This soil is used and managed like unit No. 46. This soil is in Management Group 3 for crop yield predictions.

No. 49 Great Bend Silt Loam, Sloping (6-9%)

This soil resembles unit No. 46 except that it occurs on sloping rather than gently sloping positions. It is of limited extent and occurs over the entire Glacial Lake Dakota Plain (Fig. 3) on rather steep slopes where the Lake Bed breaks to a stream bottom. This soil is slightly thinner than unit No. 46 but generally resembles it in all characteristics except slope. About 15 percent of this unit is Zell silt loam which is described in unit No. 110.

This soil is fertile and has good tilth. It is subject to serious water erosion but is not subject to drifting. It is a fair to unsuitable prospect for irrigation.

Use and Management. This soil is used approximately half the time for cropland and half the time for pasture and hayland. When cultivated it erodes seriously unless precautions are taken to control runoff by terraces and contour cultivation. This soil is capable of producing excellent pasture. A pasture stand can be improved by reseeding with a grass-legume mixture and by controlling grazing. This soil is in Management Group 10 for crop yield predictions.

No. 50 Great Bend Silt Loam, Till Substratum, Nearly Level (2-3%)

This soil differs from unit No. 46 in two respects: the profile is underlain by a substratum of firm clay loam glacial till at depths of from 2 to 5 feet, and occurs on nearly level rather than gently sloping areas. It is limited in extent and occurs along the eastern border of the Glacial Lake Dakota Plain where the lake-laid silty parent material is thin over glacial till. The till substratum is only slowly permeable and usually contains slight concentrations of salts.

This soil is fertile and has good tilth. It is slightly subject to water erosion but is not subject to drifting. This soil is a good to fair prospect for irrigation.

Use and Management. This soil is used and managed like unit No. 46. The till substratum has very little effect on the use of this soil for nonirrigated farming although it does affect its irrigation potential. This soil is in Management Group 3 for crop yield predictions.

No. 51 Great Bend Silt Loam, Till Substratum, Gently Sloping (4-5%)

This soil is the same as unit No. 46 except that the profile is underlain by a substratum of firm clay loam glacial till at depths of from 2 to 5 feet. This soil occurs along the eastern border of the Glacial Lake Dakota Plain. It is of limited extent. The till substratum usually contains slight amounts of salts and is only slowly permeable.

This is a fertile soil of good tilth. It is subject to moderate water erosion but is not subject to drifting. This soil is a good prospect for sprinkler irrigation but a poor prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 46. Although the till substratum of this soil affects its irrigation potential it has very little effect on its use for nonirrigated farming. This soil is in Management Group 10 for crop yield predictions.

No. 52 Great Bend-Zell Silt Loams, Nearly Level (2-3%)

This complex consists of two nearly level soils, the Great Bend, a moderately deep soil, and the Zell, a shallow soil. Both soils are developed in lake-laid silts. The complex is of limited extent and is found mostly in the southern part of the Glacial Lake Dakota Plain. The complex is composed of about 70 percent Great Bend and 30 percent Zell. For descriptions and diagrams of the profiles see unit No. 46 for Great Bend and unit No. 110 for Zell. This complex occurs on nearly level plains dissected by many shallow stream channels. The Great Bend soils occupy the narrow, nearly level areas between channels while the Zell soils occur on the break from the plain to the shallow channel. The La Prairie soils which are described in unit No. 94 occur in the channels and are minor inclusions in the complex. These soils and their parent materials are permeable. There may be slight concentrations of salts in the parent materials of both soils.

This complex is moderately fertile and has good tilth. It is moderately susceptible to water erosion and is subject to a slight amount of drifting. It is a fair prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This complex is used for cropland, hayland, and pasture. When cultivated it is subject to erosion because of moderate runoff. It is better adapted to hay and small grains than to corn because of erosion accompanying tillage. Whenever use of this soil for pasture is feasible, it will probably provide greater long time returns through graz-

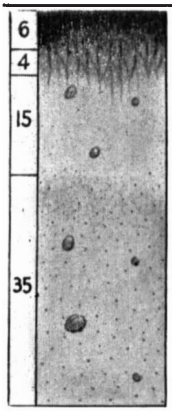
ing. Improvement of pasture stands can be done by use of nitrogen fertilizers, by reseeding, and by controlled grazing. This complex is in Management Group 8 for crop yield predictions.

No. 53 Hamerly Loam, Nearly Level (0-2%)

This is an imperfectly drained loamy soil developed in till occurring on low-lying flats usually adjacent to large sloughs. Lime occurs in the profile within 6 inches of the surface. The lime is thought to be caused by seasonal high waters which contain dissolved calcium carbonate. The soil occurs in small patches, is of limited extent, and is found mainly in western Spink County in Soil Area B (Fig. 3). The parent material is slowly permeable and contains slight to moderate amounts of salts. Scattered stones occur on and in the soil. A profile diagram and description are given in Fig. 19.

This soil is moderately fertile and has good tilth. It is slightly subject to drifting but not to water erosion. Due to the very shallow profile and the seasonal high water table of this soil it is a poor prospect for irrigation.

Fig. 19. Hamerly loam



A_1 0-6″ Very dark gray, friable loam of granular structure

B_{ca} 6-10″ Dark grayish-brown, strongly calcareous, friable loam of prismatic structure

C_{ca} 10-25″ Light gray, strongly calcareous, friable loam, slightly saline

C 25-60″ Light yellowish-brown, calcareous, loam glacial till, slightly saline

Use and Management. This soil is used mainly as native grass pasture and hayland although some of it is used for small grains and corn. If the soil is tilled problems of management include delayed planting due to wetness in the spring, lack of aeration, and low supplies of available nitrogen and phosphorus. Fall sown grain is more adapted to this soil than is spring sown grain and this will provide for a crop on the soil in the spring when it is likely to be wet. A legume in the rotation to which phosphorus fertilizer has been applied will provide for both nitrogen and phosphorus in the soil for later crops. Aeration in the soil will be improved by plowing under a legume. Use of this soil for pasture, if feasible, probably will provide greater

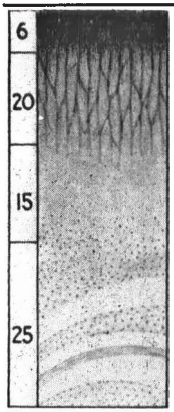
long time returns than will its use as cropland. Pasture stands can be improved by use of nitrogen and phosphorus fertilizer and by controlled grazing. This soil is in Management Group 8 for crop yield predictions.

No. 54 Hand-Houdek Loams, Gently Undulating (1-3%)

This complex consists of two gently undulating soils, the Hand soil developed in silt loam, loam, and fine sand, and the Houdek soil from glacial till. The Hand loam profile is described below and the Houdek profile is described in unit No. 67. This complex occurs on gently undulating areas which consist of a series of low round-topped rises separated by flats and slightly concave areas and a few shallow swales. The Hand soils occur on the flats and slightly concave areas in this landscape while the Houdek soils occur on the low rises. The Tetonka soils (described in unit No. 103) occur in the sloughs which are usually large enough to be shown as separate units. The approximate percentage composition of the complex is: Hand 65 percent, Houdek 30 percent, and Tetonka 5 percent. This unit is of limited extent and occurs mainly in the southwestern part of the county. A profile diagram and description for the Hand soil is given in Fig. 20. This soil and its parent material are permeable and usually nonsaline. A few stones are scattered on and in the soils.

This complex is fertile and has good tilth. It is slightly susceptible to both wind and water erosion. It is a good prospect for sprinkler irrigation but only a fair prospect for gravity irrigation.

Fig. 20. Hand loam



A_1 0-6″ Very dark gray, friable loam of granular structure

B_2 6-20″ Very dark grayish-brown, friable loam of prismatic structure

C_{ca} 20-35″ Light olive brown, friable loam, strongly calcareous

C 35-60″ Light olive brown, friable, stratified silt loam, loam, and fine sandy loam, calcareous

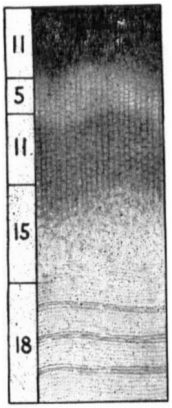
Use and Management. This complex is used principally as cropland and good yields are obtained if moisture relations are favorable. Small grains and corn are raised and a few areas are used for pasture and hayland. The principal management problem consists of maintaining a supply of

available nitrogen. This can be done by the use of a legume in the rotation or by using a commercial nitrogen fertilizer or manure. This complex is in Management Group 3.

No. 55 Harmony Silty Clay Loam, Level (0-1%)

This is a moderately well drained soil having a slight claypan. There are present minor inclusions of Aberdeen (described in unit No. 1) and Beotia (described in unit No. 15). This soil occurs on level positions on the Glacial Lake Dakota Plain, is extensive, and usually occurs in large bodies. In relation to the positions of other soils of the Lake Dakota Plain it occurs in sites not quite so well drained as the Beotia soils and better drained than the Aberdeen soils. The parent material is lake-laid silts and clays. The subsoil, which is a slight claypan, is moderately permeable. The parent material is slowly permeable and usually is moderately saline. There are no stones present. A profile diagram and description are shown in Fig. 21.

Fig. 21. Harmony silty clay loam



A_1 0-11″ Black, friable silty clay loam of granular structure

A_2 11-16″ Dark gray, friable silty clay loam of blocky structure

B_2 16-27″ Very dark brown, firm, heavy silty clay loam of blocky structure

C_{ca} 27-42″ Light olive gray, friable silty clay loam, strongly calcareous, usually moderately saline

C 42-60″ Light olive gray, friable, laminated silty clay loam, calcareous, usually moderately saline

This soil is fertile and usually has good tilth. It is not subject to either wind or water erosion. Due to the slight claypan and the slowly permeable substratum this soil is only a fair prospect for irrigation.

Use and Management. This soil is used principally for production of small grains. Corn does fairly well but root growth is restricted somewhat by the subsoil. Due to its level position and fine texture this soil may be subject to delayed planting during wet years. For this reason fall sown rather than spring sown grains are probably better adapted. Other problems of management involve the maintenance of a supply of available nitrogen and preservation of tilth. Legumes in a rotation can supply nitrogen

and aid in preserving tilth if the soil is not worked when wet. Commercial nitrogen fertilizer or manure can also supply plant nutrient needs. This soil is in Management Group 4 for crop yield predictions.

No. 56 Harmony Silty Clay Loam, Nearly Level (2-3%)

This soil is of very limited extent in Spink County and occurs on the Glacial Lake Dakota Plain. It differs from unit No. 55 by occurring on nearly level rather than level terrain. The typical position for this soil is on the lower end of gentle slopes. In soil characteristics other than slope this soil resembles unit No. 55.

This soil is fertile and usually has good tilth. It is subject to slight water erosion but not to drifting. It is a fair prospect for irrigation.

Use and Management. This soil is used and managed like unit No. 55 except that contour cultivation may be necessary to control runoff. This soil is in Management Group 4 for crop yield predictions.

No. 57 Harmony Silty Clay Loam, Till Substratum, Level (0-1%)

This soil occurs on the eastern edge of the Glacial Lake Dakota Plain where the thickness of water-laid silts and clays is about 3 to 5 feet over a substratum of firm, clay loam glacial till. This soil is of limited extent and in soil characteristics other than the presence of the till substratum it resembles unit No. 55. The till substratum of this unit is only slowly permeable and usually contains slight concentrations of salts.

This soil is fertile and usually has good tilth. It is not subject to either wind or water erosion. It is a fair prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This complex is used and managed like unit No. 55. Although significant if used for irrigation, the till substratum will have little effect upon the use of the complex for nonirrigated farming. This complex is in Management Group 4 for crop yield predictions.

No. 58 Harmony Loam, Level (0-1%)

This soil resembles unit No. 55 except that the soil has a loam rather than a silty clay loam surface. It is of limited extent and occurs mainly in the northern part of the Glacial Lake Dakota Plain. In soil characteristics other than surface texture it resembles unit No. 55.

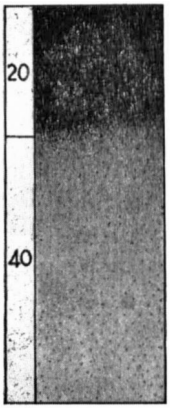
This soil is fertile and has good tilth. It is slightly susceptible to drifting but not subject to water erosion. It is a fair prospect for irrigation.

Use and Management. This soil is used like unit No. 55 except that corn is more adapted to this soil. Precautions should be taken to keep a cover on the soils to prevent any loss by drifting. This soil is in Management Group 4 for crop yield predictions.

No. 59 Hecla Sandy Loam, Nearly Level (0-2%)

This is a moderately well drained sandy loam soil occurring on nearly level positions in the sandy plain of Spink County (Soil Area C, Fig. 3). The soil is of fairly extensive occurrence over all of this plain and usually occurs in fairly large bodies. The parent material of this soil is fine sandy loam outwash that has been reworked by wind. A substratum of loam till occurs at depths of 5 to 6 feet below the surface. Drifting of this soil has occurred during dry cycles and also at other times when the surface was not covered with a crop or protected in other ways. This soil is permeable and free of salts. Small areas of this soil have been mapped along the James River in the southern end of the Glacial Lake Dakota Plain which apparently are entirely the result of wind action. A profile diagram and description of this soil are shown in Fig. 22.

Fig. 22. Hecla sandy loam



A_1 0-20″ Black, friable sandy loam of weak granular structure

C 20-60″ Dark grayish brown, loose loamy sand—profile becomes calcareous in lower part

This soil has only fair fertility but good tilth. It is susceptible to blowing but not to water erosion. It is a good prospect for sprinkler irrigation and a fair prospect for gravity irrigation.

Use and Management. This soil is used for cropland, hayland, and pasture. Corn and small grains do well if legumes are raised to provide nitrogen and organic matter. Strip cropping with alternate strips of small grain, row crop, and a grass legume mixture will reduce drifting and keep part of each field well stabilized. Keeping crop residue on the cultivated portions of this soil controls drifting. This soil is in Management Group 2 for crop yield predictions.

No. 60 Hecla Sandy Loam, Till Substratum, Nearly Level (0-2%)

This soil differs from unit No. 59 by having a loam or silty clay loam glacial till substratum occurring at depths of from 3 to 5 feet from the surface. This substratum aids in forming a temporary water table in this soil during the spring of the year. This soil is of very limited extent and occurs in southwest Spink County in Soil Area C (Fig. 3). The soil profile is permeable and free of salts but the substratum is apparently only slowly permeable and is slightly saline. In soil characteristics other than presence of the till substratum, this soil is the same as unit No. 59.

This soil has limited fertility but good tilth. It is subject to drifting but is not susceptible to water erosion. This soil is a good prospect for sprinkler irrigation but a poor prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 59. The presence of the till substratum may give this soil slightly better moisture relations by preventing water from draining away internally. This soil is in Management Group 2 for crop yield predictions.

No. 61 Hecla Loamy Fine Sand, Nearly Level (0-2%)

This is a sandy soil occurring on nearly level positions in the sandy plain of Spink County, Soil Area C (Fig. 3). This soil is of rather limited occurrence and differs from unit No. 59 by having a loamy sand rather than a sandy loam surface. In soil characteristics other than texture of the surface it resembles unit No. 59.

This soil has rather low natural fertility but good tilth. It is very susceptible to drifting but not to water erosion. It is a good prospect for sprinkler irrigation and a fair prospect for gravity irrigation.

Use and Management. In most cases this soil should be kept in some type of perennial vegetation, or the choice and sequence of crops should be arranged that fields are protected either by a growing crop or crop residues throughout the year. When farmed using wind strip cropping, strips should be narrow enough so that soil does not drift into the crop strips. Corn and alfalfa are adapted crops for this soil. This soil is in Management Group 1 for crop yield predictions.

No. 62 Hecla Loamy Fine Sand, Till Substratum, Nearly Level (0-2%)

This soil resembles unit No. 61 except that in this soil glacial till occurs within 3 feet of the surface. This soil is of limited extent in the county and occurs in Soil Area C (Fig. 3). This soil is permeable down to the glacial till which is only slowly permeable.

This soil has rather low natural fertility but good tilth. It is very susceptible to drifting but not to water erosion. It is a good prospect for sprinkler irrigation but a poor prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 61. Moisture relations are usually more favorable in this soil than in unit No. 61 because the underlying till strata tends to keep moisture from draining out of reach of crop roots. This soil is in Management Group 1 for crop yield predictions.

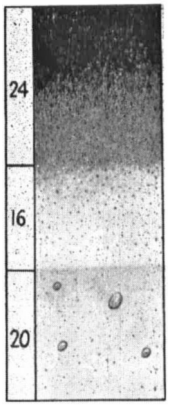
No. 63 Hecla-Hamar Loamy Fine Sands, Nearly Level (0-2%)

This complex consists of two nearly level soils developed in outwash sand. The Hecla soils are moderately well drained and occur in flats on an outwash plain while the Hamar soils are imperfectly drained and occupy low lying areas. The complex is of limited extent and is composed of about 70 percent Hecla and 30 percent Hamar. The Hecla soils are described in unit No. 59 while the Hamar soils are described below. Both soils are permeable but an underlying clayey substratum causes a periodic water table in both soils which is pronounced in the Hamar and slight in the Hecla. A profile diagram and description of Hamar are given in Fig. 23.

This complex has only fair fertility but good tilth. It is susceptible to drifting but not to water erosion. It is a fair prospect for irrigation.

Use and Management. This complex is used and managed like unit No. 62. It is in Management Group 1 for crop yield predictions.

Fig. 23. Hamar loamy fine sand



A_1 0-24″ Black, grading into very dark grayish-brown, loamy fine sand

C_g 24-40″ Light yellowish-brown with light gray flecks; loamy fine sand, calcareous

D_{ca} 40-60″ Light yellowish-brown, loam or silty clay loam glacial till, calcareous

No. 64 Hecla-Hamar Loamy Fine Sands, Wind Eroded, Hummocky (0-2%)

This complex resembles unit No. 63 except that drifting has been severe and left the surface in a hummocky condition. This unit occurs in

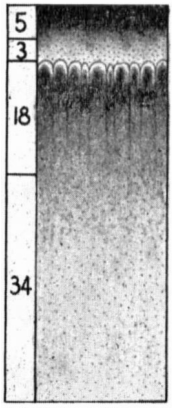
Soil Area C (Fig. 3). With the present surface condition these soils are only a fair prospect for sprinkler irrigation. They are a poor prospect for gravity irrigation.

Use and Management. These soils were severely eroded by wind in the 1930's; however, much of the area covered by this unit was farmed in the 1940's. In farming these soils they are protected best from drifting by having a cover of perennial vegetation. If this is not possible the choice and sequence of crops should be such that the soil is covered with a crop or residues throughout the year. This complex is in Management Group 1 for yield predictions.

No. 65 Hecla-Letcher Loamy Fine Sands, Nearly Level (0-2%)

This complex is composed of about 65 percent Hecla and 35 percent Letcher and occurs mainly in southwestern and southern Spink County. The Hecla is a moderately well drained sandy soil while the Letcher is a sandy soil having a sandy clay loam subsoil. The Hecla profile is described under unit No. 59 and the Letcher profile is described below. This complex occurs on a nearly level alluvial plain which consists of flat areas with a scattering of shallow sloughs. The Hecla soils occur on the flats while Letcher soils occur in the shallow sloughs. A profile diagram and description of the Letcher is given in Fig. 24.

Fig. 24. Letcher loamy fine sand



A_1 0-5" Black, friable loamy fine sand of granular structure

A_2 5-8" Dark grayish-brown loamy fine sand

B_2 8-26" Black to very dark grayish-brown sandy clay loam of columnar structure

C_g 26-60" Dark grayish-brown and yellowish-brown sand, weakly calcareous

This complex has rather low fertility but good tilth unless tillage has incorporated the subsoil into the surface soil. This complex is subject to drifting but not to water erosion. It is a fair prospect for sprinkler irrigation but a poor prospect for gravity irrigation.

Use and Management. This complex is used mainly for pasture and hayland although some is cultivated. This soil will drift if not covered. If cultivated the choice and sequence of crops should be such that the soil is covered at all times with a crop or crop residue. This complex is in Management Group 5 for crop yield predictions.

No. 66 Hecla-Letcher Sandy Loams, Nearly Level (0-2%)

This complex resembles unit No. 65 except that the included soils are sandy loams rather than loamy fine sands. It occurs in an area southwest of the village of La Delle and also in the southwestern and southern parts of the county.

This complex has rather low fertility but a good tilth unless the subsoil has been incorporated into the surface soil by tillage. This complex is subject to drifting but not to water erosion. It is a fair prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This complex is used and managed like unit No. 65. It is in Management Group 5 for crop yield predictions.

No. 67 Houdek-Bonilla Loams and Silt Loams, Undulating (3-5%)

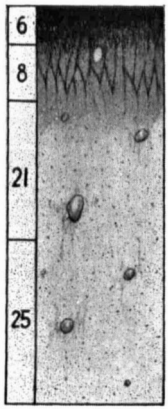
This complex consists of two undulating soils developed in glacial till. The Houdek profile is described below while the Bonilla profile is described in unit No. 23. This complex occurs on undulating areas which consist of a series of low, round-topped hills interspersed with areas of gentler slopes, flats, and swales, and a scattering of prominent sloughs. Local relief differences between the tops of the low hills and the sloughs are from 10 to 30 feet or more. The Houdek soils occupy the low round-topped hills while the Bonilla soils occur on the gentler slopes and the Cresbard soils (described in unit No. 33) occupy the flats. The Tetonka soils described in unit Nos. 103 and 104 occur in the swales and sloughs which are usually large enough to be shown separately and are not included in the complex. The approximate percentage composition of the complex is: Houdek 60 percent, Bonilla 25 percent, and Cresbard 10 percent. About 5 percent of this landscape has moderate to severe erosion and these areas are occupied by thin Houdek soils. The soils of this complex are moderately permeable, but the glacial till substratum is only slowly permeable and usually contains a slight to moderate concentration of salts.

This complex is extensive in Spink County and occurs principally in the western part of the county, although some occurs in the southern and eastern parts. There are a few stones scattered on and in the soils. A profile diagram and description of the Houdek soil is presented in Fig. 25.

This complex is fertile and usually has good tilth. It is slightly susceptible to wind and water erosion. It is a good prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This complex is used for both cropland and hayland. Spring wheat usually does better than corn. The principal management problems are the maintenance of soil fertility, especially nitrogen, and soil organic matter. Prevention of water erosion on the Houdek soils which occur on the crests of the low hills is another problem of management. Soil fertility and organic matter can be maintained by inclusion of a legume in the rotation. Water erosion on the crests of the hills can be controlled most satisfactorily by leaving the eroded spots in perennial vegetation. Leaving the soil in a rough condition and using stubble mulch tillage are practices which will reduce runoff and control drifting. This complex is in Management Group 13 for yield predictions.

Fig. 25. Houdek loam



A_1 0-6″ Very dark brown, friable loam of prismatic and granular structure

B_2 6-14″ Dark brown, friable loam of prismatic structure

C_{ca} 14-35″ Light olive brown, friable glacial till, strongly calcareous, usually moderately to slightly saline

C 35-60″ Light olive brown, friable glacial till, moderately calcareous, usually moderately to slightly saline

No. 68 Houdek-Bonilla Loams and Silt Loams, Stony, Undulating (3-5%)

This unit is the same as unit No. 67 except that this unit is stony. It is estimated that there are present from 5 to 20 cubic yards-per-acre-foot of stones larger than 10 inches in diameter. This complex is of rather limited extent and occurs mainly in the south central part of the county. In soil qualities this soil is similar to unit No. 67 except that stoniness makes this unit only a fair prospect for sprinkler irrigation. It is a poor prospect for gravity irrigation.

Use and Management. The degree of stoniness of this complex interferes with tillage operations so that a rather high percentage of this soil is used for hayland and pasture. If cleared of stones this soil is used and managed like unit No. 67, the nonstony type. This soil is in Management Group 13 for crop yield predictions.

No. 69 Houdek-Bonilla Silt Loams, Undulating (3-5%)

This complex is similar to unit No. 67 except that the included soils are all of a silt loam surface texture. This unit occurs in the eastern part of Spink County. This complex is fertile and has good tilth. It is slightly susceptible to water erosion and drifting. It is a good prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This complex is used and managed like unit No. 67. It is in Management Group 13 for crop yield predictions.

No. 70 Houdek-Bonilla Silt Loams, Stony, Undulating (3-5%)

This complex is similar to unit No. 67 except that it is stony and the included soils are all silt loams. It is estimated that there are present from 5 to 20 cubic yards-per-acre-foot of stones larger than 10 inches in diameter. This unit occurs in the eastern and south central parts of Spink County and is of limited extent.

This complex is fertile and has good tilth. It is slightly susceptible to water erosion and drifting. It is a poor prospect for gravity irrigation.

Use and Management. This complex is used and managed like unit No. 68. It is in Management Group 13 for crop yield predictions.

No. 71 Houdek Loam-Crandon Gravelly Loam, Undulating (3-5%)

This complex consists mainly of two undulating soils, the Houdek developed in loam glacial till and the Crandon developed in gravelly outwash. The Houdek profile is described in unit No. 67 and the Crandon in unit No. 32. This complex occurs on undulating areas which consist of an irregular line of low, choppy hills with intervening areas of less relief and a few swales. The Crandon soils occupy gravelly knobs on the low hills while the Houdek soils occupy the areas of less relief. A third component of this complex is the Tetonka soil (described in unit No. 103) which occurs in the swales. Local relief differences are from 15 to 25 feet or more. The approximate percentage composition of the complex is 65 percent Houdek, 25 percent Crandon, and 10 percent Tetonka. This complex occurs scattered in the till areas in the county on recessional or end moraines. It is of limited occurrences in the county. Stones occur, especially on the Crandon soils.

The Houdek soils of this complex are fertile and have good tilth while the Crandon soils have fair fertility. The complex is only slightly susceptible to wind and water erosion. It is a poor prospect for sprinkler irrigation and unsuitable for gravity irrigation.

Use and Management. This soil is used mainly for pasture and hayland. The presence of the Crandon soils in the complex is undesirable as these soils are gravelly and stony. Where small percentages of Crandon are

present, this complex is under cultivation and is used and managed like unit No. 67. It is in Management Group 13 for crop yield predictions.

No. 72 Houdek Silt Loam, Firm Till Substratum, Undulating (3-5%)

This is a well-drained soil developed in friable loam glacial till overlying a firm, clay loam glacial till. It is similar in profile characteristics to unit No. 67. This soil occurs in eastern Spink County and is of rather limited extent. The soil profile is permeable but the underlying glacial till is only slowly permeable and contains slight to moderate concentrations of salt. There is a scattering of stones in and on the soil.

This soil is fertile and has good tilth. It is subject to slight water erosion and drifting. It is a good prospect for sprinkler irrigation but a poor prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 67. It is in Management Group 13 for crop yield predictions.

No. 73 Houdek-Cavour Loams and Silt Loams, Gently Undulating (2-3%)

This complex consists of two soils, the Houdek which is friable and the Cavour which has a claypan subsoil. Both are developed in glacial till. This complex, which occurs principally in western Spink County, is found on gently undulating areas which consist of a succession of low rises and gentle swales. The Houdek soils occur on the low rises while the Cavour soils occupy the gentle swales. The approximate percentage composition of the complex is 70 percent Houdek and 30 percent Cavour. This complex is of rather limited extent in the county. Stones are scattered in and on the soils.

This complex is fertile and usually has good to fair tilth. It is subject to slight water and wind erosion. It is a fair prospect for sprinkler irrigation and is usually unsuitable for gravity irrigation.

Use and Management. This complex is used and managed like unit No. 67. The swale areas occupied by the Cavour soils may be too wet to work in the spring when the Houdek soils are ready to go. This complex is in Management Group 13 for yield predictions.

No. 74 Houdek-Bonilla Fine Sandy Loams, Undulating (3-5%)

This complex has the same composition as unit No. 67 but differs from it in that all included soils have fine sandy loam surface soils rather than loams and silt loams. This unit is of rather limited extent and occurs in southwestern Spink County within or near Soil Area C (Fig. 3). The fine sandy loam surface soil was formed largely as a result of soil blowing. Fine sand material blew off the outwash plain and was deposited like a blanket over the nearly level till plain. The thickness of this fine sandy

loam surface varies from about 8 to 12 inches. This soil has a high water intake rate because of the fine sandy loam surface, and it also has good water-holding capacity because of the finer textured subsoil. The underlying glacial till is only slowly permeable and may contain moderate amounts of salt.

This complex is moderately fertile and has good tilth. It is quite susceptible to drifting but is only slightly subject to water erosion. This complex is a good prospect for sprinkler irrigation and a fair prospect for gravity irrigation.

Use and Management. This complex is used for the production of corn and small grains and for pasture and hayland. The principal management problems concern the control of wind erosion and the maintenance of fertility. Planting alternate strips of open-tilled and close growing crops at right angles to the prevailing wind, and keeping crop residues on the land when it is not protected by crops will tend to stabilize these soils. Fertility, especially nitrogen, can be maintained by growing legumes or using commercial fertilizers or manure. This soil is in Management Group 12 for yield predictions.

No. 75 Houdek-Groveland Fine Sandy Loams, Undulating (3-5%)

This complex consists of two well-drained undulating soils. The Houdek is developed in glacial till, and the Groveland is stratified loam and fine sand. The complex is composed of about 60 percent Houdek and 40 percent Groveland. The Houdek profile is described in unit No. 67 and the Groveland profile is described in unit No. 28. This complex occurs on undulating areas. These two soils occur intimately together and neither one seems to have a characteristic position. Because of the association with the stratified Groveland, the entire Houdek profile contains more sand than the normal type. For this reason permeability of both members of this complex is fair and salts do not usually occur within 5 feet of the surface. A scattering of stones may occur on and in the soil.

This complex is fertile and has good tilth. It is slightly subject to water erosion and quite susceptible to drifting. It is a good prospect for sprinkler irrigation and a fair prospect for gravity irrigation.

Use and Management. This soil is used principally for cropland and good yields of corn and small grain are obtained. Management needs to provide for protection against drifting. Legume-grass mixtures will provide the soil with organic matter and a source of available nitrogen. This soil is in Management Group 12 for yield predictions.

No. 76 Houdek Fine Sandy Loam, Thin Solum, Undulating (3-7%)

This soil resembles unit No. 67 except that it has a thin solum (8 to 12 inches thick), and a fine sandy loam rather than a loam surface soil. This

soil occurs in southwest Spink County and is of limited extent. A scattering of stones may occur on the soil surface.

This soil is moderately fertile and usually has good tilth. It is susceptible to drifting and water erosion. It is a fair prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 67. Protection from drifting and water erosion are more important on this than on unit No. 67 because of the fine sandy loam surface soil and the thin solum. This soil is in Management Group 12 for crop yield predictions.

No. 77 Houdek Loam, Thin Solum, Undulating (3-5%)

This soil resembles the regular Houdek described in unit No. 67 except that it has a thinner solum. The surface and subsoil together only total about 8 to 12 inches in this soil. This soil occurs principally in western Spink County and is of fairly limited extent. A scattering of stones occurs on and in this soil. It is moderately fertile and usually has good tilth. It is subject to wind erosion and water erosion. It is a fair prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 67. Yields are slightly lower on this soil than they are on unit No. 67. Because of the thin solum care must be taken to control runoff and erosion on this soil. It is in Management Group 13 for crop yield predictions.

No. 78 Houdek Loam, Rolling (6-9%)

This soil resembles unit No. 67 except that it occurs on rolling rather than undulating slopes. This soil occurs in western Spink County and is of limited extent. A few stones may be scattered on the soil surface. This soil is fertile and has good tilth. It is very susceptible to water erosion and slightly susceptible to drifting. It is a poor prospect for sprinkler irrigation and is unsuitable for gravity irrigation.

Use and Management. This soil is used mostly for hayland and pasture although some is cropped. The rolling terrain of this soil makes it susceptible to runoff if cultivated. When used for pasture, management consists principally of controlled grazing. This soil is in Management Group 15 for yield predictions.

No. 79 Houdek Silt Loam, Rolling (6-9%)

This soil resembles unit No. 67 except that it occurs on rolling rather than undulating slopes and has a silt loam rather than a loam surface soil. It occurs is eastern Spink County and is of limited extent. A few stones may be scattered on the soil surface. This soil is fertile and has good tilth. It is

very susceptible to water erosion and slightly subject to drifting. It is a poor prospect for sprinkler irrigation and is unsuited for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 78. It is in Management Group 15 for yield predictions.

No. 80 Houdek Loam, Thin Solum, Rolling (6-9%)

This soil resembles unit No. 67 except that it has a thin solum and occurs on rolling terrain while unit No. 67 occurs on undulating topography. The surface and subsoil together are 8-12 inches thick in this soil. This soil is found in western Spink County and is of limited extent. A scattering of stones may occur on the soil surface.

This soil is moderately fertile and has good tilth. It is very susceptible to water erosion and slightly susceptible to drifting. It is unsuitable for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 78. It is in Management Group 15 for crop yield predictions.

No. 81 Houdek Silt Loam, Firm Till Substratum, Rolling (6-9%)

This soil differs from unit No. 67 in two respects: it has a firm clay loam substratum and occurs on rolling topography. Unit No. 67 has a friable loam substratum (parent material) and occurs on undulating topography. The firm till substratum of this soil is very slowly permeable and usually is slightly saline. This soil occurs in eastern Spink County and is fairly limited in extent. It is fertile and has good tilth. It is susceptible to water erosion and to some drifting. This soil is a poor prospect for sprinkler irrigation and is unsuitable for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 78. It is Management Group 15 for yield predictions.

No. 82 Houdek Loam-Crandon Gravelly Loam, Rolling (6-9%)

This complex consists of two rolling soils, the Houdek developed in a loam glacial till and the Crandon developed in gravelly outwash. The Houdek profile is described in unit No. 67 and the Crandon profile is described in unit No. 32.

This complex occurs on rolling areas which consist of a series of round-topped, rather steep-sided hills interspersed with areas of gentler slopes, swales, and a few prominint sloughs. Local relief differences are from 15 to 40 feet or more. The Crandon soils occupy the steeper, gravelly slopes and knobs in this terrain while the Houdek soils occur on the gentler slopes and the Tetonka soils (units No. 103 and 104) occupy the swales and sloughs. The approximate percentage composition of the complex is: Hou-

dek 65 percent, Crandon 25 percent, and Tetonka 10 percent. This unit is of rather limited extent in the county. Stones and boulders commonly occur, especially on the Crandon soils.

This complex has fair to moderate fertility. It is subject to high rates of runoff and usually erodes when cultivated. It is not suited for irrigation.

Use and Management. This complex is used mainly for pasture. Where so used the composition and quality of the stand can be improved by reseeding with grass-legume mixtures and by controlled grazing. This complex is in Management Group 15 for yield predictions.

No. 83 Houdek Loam, Very Stony, Rolling (6-9%)

This is a well-drained soil similar in general profile characteristics to unit No. 67 except that it is very stony and occurs on rolling, rather than undulating slopes. It occurs mainly in western Spink County.

This soil is fertile and has good tilth but stoniness and slope limit its use to pasture and possibly hayland. This soil is subject to water erosion but not to drifting. It is unsuited for irrigation.

Use and Management. This complex is used mainly for pasture. The quality of the pasture stand can be improved by reseeding with grass-legume mixtures and by controlled grazing. This soil is in Management Group 15 for yield predictions.

No. 84 Houdek-Orient Loams, Hilly (10-30%)

This complex consists of two hilly soils, the profile of the Orient being very shallow while the Houdek profile of this complex is moderately shallow. The Houdek profile is generally similar to the one described in unit No. 67 except that it is only 8-12 inches thick. The Orient profile is described in unit No. 99.

This complex occurs on hilly areas or on steep slopes where the upland breaks to a stream bottom. On sloping areas the thin Orient soils occur just at the crest of the break and comprise about 35 percent of the complex. The thin solum Houdek soils make up the slope below the crest (about 45 percent of the complex) while the regular Houdek soils and the Bonilla soils, which have thicker profiles, occupy the foot slope positions and together make up 20 percent of the complex. Stoniness is common on the soils of this complex. It has rather low fertility. This complex is subject to high rates of runoff and erodes badly if cultivated. It is unsuited for irrigation.

Use and Management. This soil is used primarily for pasture. The composition and quality of the stand can be improved by reseeding with a grass-legume mixture and by controlled grazing. See Management Group 16 for stocking rates.

No. 85 Houdek-Orient Loams, Very Stony, Hilly (10-30%)

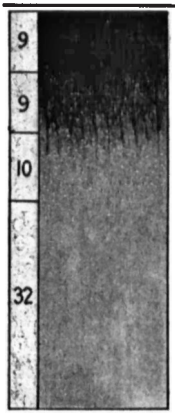
This complex is the same as unit No. 84 except that there are 15 to 30 or more cubic-yards-per-acre-foot of stones present. This complex is of limited extent and occurs on steep valley slopes or hilly ridges.

Use and Management. This soil is used like unit No. 84. It is in Management Group 16 for stocking rates for livestock.

No. 86 La Delle Silt Loam, Level (0-1%)

This is a moderately well drained friable soil occurring on level positions on stream terraces or high bottoms along the James River and its larger tributaries. The soil is extensive in the county. The parent material is friable silt loam or silty clay loam stream deposited sediment. The soil profile is moderately permeable yet has good water holding capacity. There are two main variations in the profiles: in some areas gravel is encountered below the profile at 36 inches or deeper and in some areas buried soil profiles occur at depths of 2 feet or more. A profile digram and description are shown in Fig. 26.

Fig. 26. La Delle silt loam



A_1 0-9″ Black, friable silt loam of granular structure

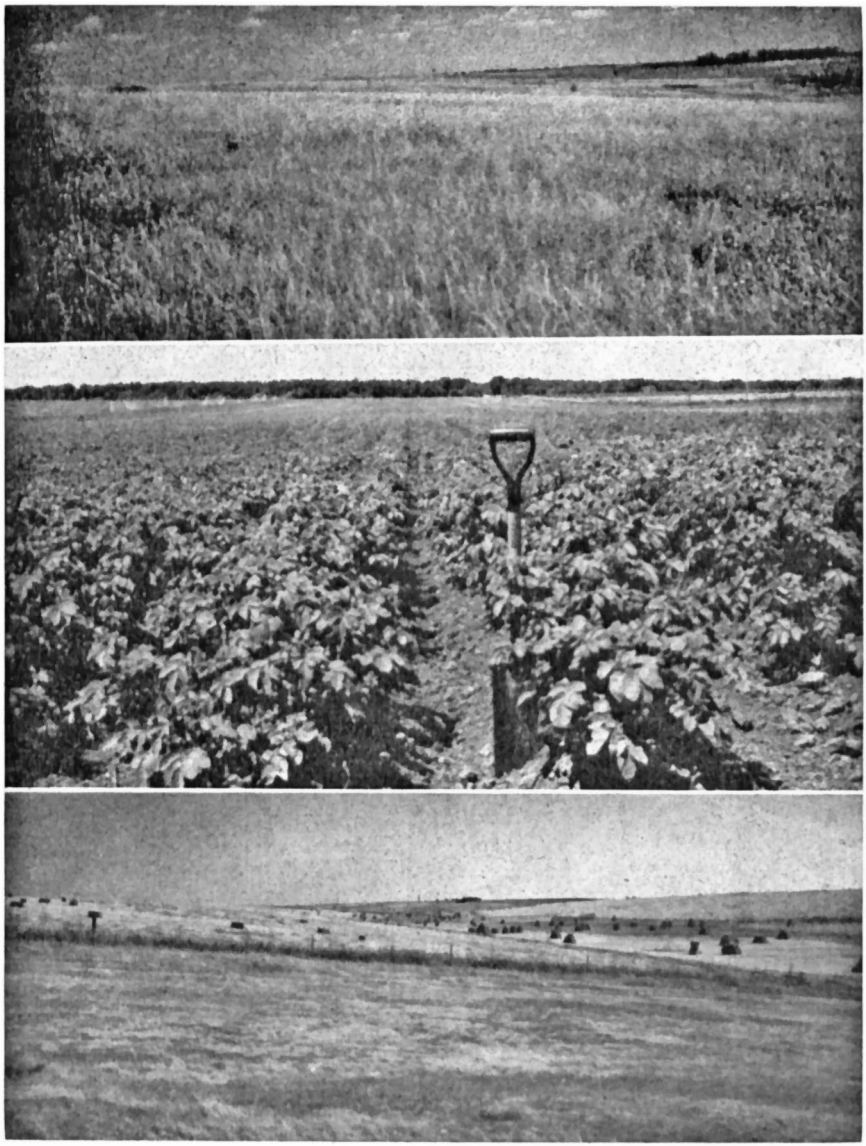
B_2 9-18″ Black to very dark brown silty clay loam of coarse prismatic structure

C_{ca} 18-28″ Dark grayish-brown silt loam or silty clay loam, strongly calcareous, occasionally slightly saline

C 28-60″ Dark grayish-brown, silt loam or silty clay loam, calcareous alluvium, slightly saline

This soil is fertile and has good tilth. It is not subject to water erosion or drifting but occasionally it is subject to overflow. It is an excellent prospect for sprinkler irrigation especially of alfalfa or of special crops such as potatoes. It is a fair prospect for gravity irrigation.

Use and Management. This soil is used mainly for cropland and hayland and good yields are obtained of corn, wheat, and alfalfa. Fertility can be maintained easily by following a rotation that includes a legume. This soil is in Management Group 3 for crop yield predictions.



Photos by C. A. Mogen, SCS

Top: Area of Great Bend silt loam on gentle slope down to drain. The soil in the drain is La Prairie silt loam. *Middle:* An area of La Delle silt loam, a terrace soil along the James River. The field is in potatoes and is being irrigated by sprinkler. *Bottom:* The soils on the slope are Great Bend. On the stream bottom (in background) Lamoure soils occur. They are used principally for hay production because of occasional overflow.

No. 87 La Delle Silt Loam, Nearly Level (2-3%)

This soil is the same as unit No. 86 except that it occurs on nearly level rather than level topography. It has the same general distribution, characteristics other than slopes, and qualities as unit No. 86.

Use and Management. This soil is used and managed like unit No. 86. It is in Management Group 3 for crop yield predictions.

No. 88 La Delle Silty Clay Loam, Level (0-1%)

The soil is generally similar to unit No. 86 except that the surface soil is a silty clay loam rather than a silt loam. It occurs on slightly lower positions than unit No. 86, is not quite so well drained, and is more subject to overflow. This soil is fertile and has good to fair tilth. It is not subject to water erosion or drifting. It is a fair prospect for sprinkler irrigation and a poor prospect for gravity irrigation.

Use and Management. This soil is used for cropland and hayland mainly and some for pasture. It is a productive soil but, because of its moderately fine texture and because it is subject to overflow occasionally, tilth is sometimes difficult to maintain. If care is taken that the soil is not worked when wet, tilth maintenance is usually not difficult. This soil is in Management Group 4 for crop yield predictions.

No. 89 La Delle-Lamoure Silt Loams, Nearly Level (0-2%)

This complex includes moderately well drained La Delle soils and poorly drained Lamoure soils. About 60 percent of the complex is La Delle and 40 percent is Lamoure. This complex is extensive and occurs principally on the stream bottom of the James River and on the bottoms of the streams flowing through western Spink County. The parent material is calcareous, stratified alluvium of silt loam, loam, and fine sandy loam texture. The parent material of both soils is moderately permeable and slightly saline. La Delle is described in unit No. 86 and Lamoure is described in unit No. 92.

This complex is fertile and of good tilth. It is not subject to water or wind erosion. It floods occasionally. It is a good prospect for small scale sprinkler irrigation projects if fields are not cut up by meanders of the stream. It is considered unsuitable for large scale gravity irrigation systems because there is a good possibility that a high water table would develop.

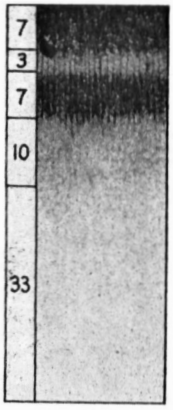
Use and Management. This complex is used largely for hayland and pasture because fields are usually small and of irregular shape due to meanders of the stream. When fields are large this soil is used for cropland and good yields are obtained of small grains and corn. Alfalfa does well on this soil because there is adequate moisture for the deep-feeding roots.

Occasionally overflow occurs on this soil but water rarely stands after flooding; it is absorbed in the soil or drains away. This soil is in Management Group 17 for crop yield predictions.

No. 90 La Delle-Northville Silty Clay Loams, Level (0-1%)

This complex consists of two soils developed in alluvium, the La Delle which is friable, and the Northville which has a claypan. The La Delle is described in unit No. 86 and the Northville is described in Fig. 27. This complex occurs on level stream terraces and high bottoms which consist of flats broken by very shallow swales. The La Delle soils occur on the flats

Fig. 27. Northville silty clay loam



A_1 0-7″ Black, friable silty clay loam of granular structure

A_2 7-10″ Dark brown, friable silt loam of blocky structure

B_2 10-17″ Very dark brown, compact silty clay loam of blocky structure

C_{ca} 17-27″ Olive brown, friable, silty clay loam, strongly calcareous, usually moderately saline

C 27-60″ Light yellowish-brown to olive brown silty clay loam or silt loam

and the Northville soils occur in the swales. The approximate percentage composition of the complex is La Delle 70 percent and Northville 30 percent. This unit is fairly extensive in Spink County. The Northville soils of this complex are only slowly permeable.

This complex is moderately fertile and has good tilth except where tillage has brought the claypan into the plow layer. It is not subject to either wind or water erosion. This complex is a poor prospect for sprinkler irrigation and is unsuitable for large scale gravity irrigation because of the low permeability of the Northville soils.

Use and Management. This complex is used for cropland and hayland principally. Fertility can be easily maintained by inclusion of a legume in the rotation. Tilth may be difficult to maintain if the slight swales occupied by the Northville soils are worked when wet or worked deeply enough to incorporate some of the claypan into the surface soil. This complex is in Management Group 4 for crop predictions.

No. 91 La Delle-Northville Silt Loams, Level (0-1%)

This complex resembles unit No. 90 except that the surface soils of both members of this complex are silt loams rather than silty clay loams. This complex also occupies slightly higher positions than unit No. 90 and hence receives less overflow.

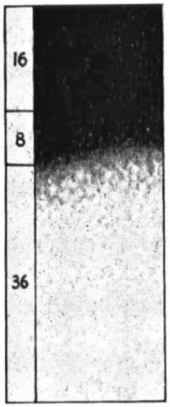
This complex is moderately fertile and has good tilth. It is not subject to either water erosion or drifting. It is a fair prospect for sprinkler irrigation but is unsuitable for large scale gravity irrigation because of the rather low permeablilty of the included Northville soils.

Use and Management. The La Delle-Northville silt loams, level, complex is used for cropland and hayland, especially alfalfa. Fertility can be maintained if legumes are grown. Maintenance of soil tilth may present a problem if the soil is worked when too wet or if worked so deeply that some of the claypan is incorporated into the surface soil. This soil is in Management Group 4 for crop yield predictions.

No. 92 Lamoure Silty Clay Loam

This is a poorly drained soil developed on stream bottoms from stream deposited materials of moderately fine texture. This soil is extensive in Spink County and occurs on the bottoms of the James River and its tributaries. This soil has low permeability and is subject to flooding by stream overflow and by water from adjacent uplands. The profile is calcareous at or near the surface and may be slightly saline in the lower part of the profile and in the parent material. A diagram of the profile is shown in Fig. 28 and the profile is described below.

Fig. 28. Lamoure silty clay loam



A_1 0-16″ Black, calcareous, friable silty clay loam of granular to blocky structure

B_2 16-24″ Black to very dark gray, calcareous, friable silty clay loam of very weak blocky structure

C_g 24-60″ Gray, calcareous silty clay loam with spots of dark gray and white

The Lamoure silty clay loam is moderately fertile and has good to fair tilth. It is not subject to drifting or water erosion. It is a poor prospect for sprinkler irrigation and is unsuitable for gravity irrigation.

Use and Management. The Lamoure silty clay loam is used mainly for hayland and pasture. Poor drainage causes two problems of management: poor aeration and poor permeability for water and plant roots. This soil will produce excellent grass hay and pasture but is usually too poorly drained for good legume growth. It is in Management Group 18 for hay yield predictions and livestock stocking rates.

No. 93 Lamoure Silty Clay Loam, Saline

This soil is the same as unit No. 92 except that it is moderately saline at or near the surface. It occurs principally on the stream bottoms in eastern Spink County. Except for salinity it has the same general characteristics as unit No. 92 and is unsuited for irrigation.

Use and Management. This soil is used and managed like unit No. 92. It is in Management Group 18 for hay yield predictions and stocking rates.

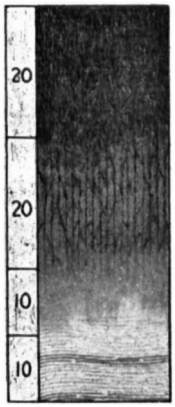
No. 94 La Prairie-Tetonka Silt Loams, Nearly Level (0-2%)

This complex includes two imperfectly drained soils developed in alluvial materials. The La Prairie soil is described below and the Tetonka soils are described in unit No. 103. This complex occurs in shallow, narrow channels in the Glacial Lake Dakota Plain. The floor of these channels consists of a series of small depressions separated by flats strung out along the channel. The La Prairie soil occurs on the flats on this narrow valley floor while the Tetonka soils occupy the shallow depressions. The approximate percentage composition of this complex is La Prairie 65 percent, Tetonka 35 percent. This complex occurs in strung-out units which are so narrow that many of them are not shown on the soil map but are included with adjacent Great Bend and Beotia soils. Permeability through these soils is usually slow. There are no salts present. The La Prairie profile is shown and described is Fig. 29.

This complex is fertile and has good tilth. It is not subject to water erosion or drifting. It is unsuitable for irrigation because of its position in narrow bottoms.

Use and Management. This complex is usually farmed with adjacent soils where well enough drained. When cultivated it is very productive wheat and corn soil. This soil is in Management Group 17 for crop yield predictions.

Fig. 29. La Prairie silt loam



A_1 0-20″ Very dark brown, friable silt loam of weak prismatic or blocky structure

B_2 20-40″ Very dark grayish-brown, friable silty clay loam of prismatic or blocky structure

C_{ca} 40-50″ Light olive brown, friable silt loam, weakly calcareous

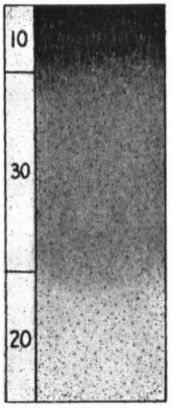
C 50-60″ Light olive brown, laminated silt loam and silty clay loam

No. 95 Maddock Sandy Loam, Undulating (3-5%)

This is a well to excessively drained sandy soil developed in outwash sands that have been reworked by wind. It occurs on undulating terrain which consists of a series of low, round-topped hills separated by nearly level areas. The soil profile is permeable and free of salts. This soil occurs in southwestern Spink County in Soil Area C (Fig. 3). A profile diagram (Fig. 30) and description follow.

This soil has rather low fertility but good tilth. It is subject to drifting, but not to water erosion. It is a fair prospect for sprinkler irrigation, and a poor prospect for gravity irrigation.

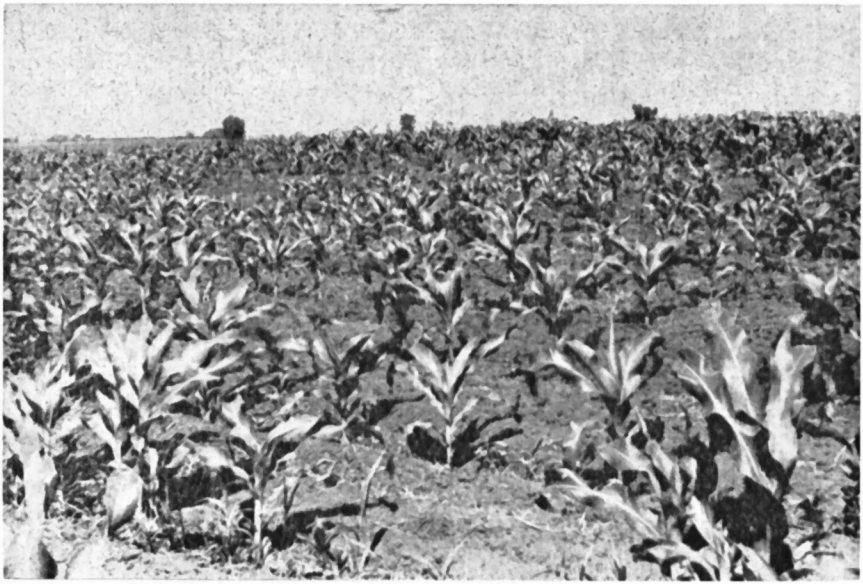
Fig. 30. Maddock sandy loam



A_1 0-10″ Very dark grayish-brown, friable sandy loam

C_1 10-40″ Brown loamy fine sand

C_{ca} 40-60″ Pale brown loamy fine sand



Landscape of Maddock sandy loam, undulating. Although much of this soil has been reclaimed and is productive, there are some areas which still show wind erosion damage.

Use and Management. Maddock sandy loam, undulating, is used for corn, pasture and hayland. When cultivated, the soil should be protected at all times with a crop or crop residues. This soil is in Management Group I for yield predictions.

No. 96 Maddock Loamy Fine Sand, Till Substratum, Undulating (3-5%)

This soil is developed on undulating terrain in the sandy plain of the county, Soil Area C (Fig. 3). The soil profile consists of wind-reworked outwash sand which overlies a firm, loamy till. The soil profile is permeable but the underlying strata is only slowly permeable and acts to prevent draining away of water through the profile. This soil resembles unit No. 95 except that it has a loamy fine sand, rather than a sandy loam surface, and because glacial till is encountered at depths of about 3 feet.

This soil has fair fertility but good tilth. It is very susceptible to drifting but not to water erosion. It is a fair prospect for sprinkler irrigation but is unsuitable for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 95. It is in Management Group 1 for crop yield predictions.

No. 97 Maddock-Hamar Loamy Fine Sand, Wind Eroded, Hummocky (3-5%)

This complex includes Maddock, an excessively drained sandy soil, and Hamar, an imperfectly drained sandy depressional soil. Much wind

erosion has occurred in the part of Soil Area C (Fig. 3) where this complex is found. This has resulted in a hummocky or dune-like landscape. This complex contains about 75 percent Maddock and 25 percent Hamar. The Maddock is described in unit No. 95 and the Hamar is described in unit No. 63.

This complex has rather low fertility. It is very susceptible to drifting. It is a fair prospect for sprinkler irrigation if leveled, but it is a poor prospect for gravity irrigation.

Use and Management. This complex should be kept in some type of perennial vegetation or the choice and sequence of crops should be such that the land is protected during all the year. This complex is in Management Group 1 for yield predictions.

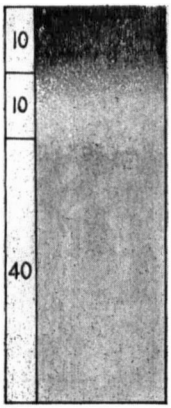
No. 98 Maple Silty Clay Loam

This is a poorly drained soil developed in salty, moderately fine textured alluvium. It occurs on bottoms of present-day streams and on backwater settling basins on glacial flood plains. This soil occurs in scattered patches over the entire county but the largest acreage is in the eastern part of the county. This soil is only slowly permeable and moderately to strongly

Photo by W. M. Johnson, SCS

Crayfish chimneys in road ditch on Maple soil material. The Maple soils are poorly drained and calcareous.

Fig. 31. Maple silty clay loam



A_1 0-10″ Black, calcareous, friable silty clay loam of granular or weak blocky structure

B_g 10-20″ Nearly white (when dry), calcareous, saline silty clay loam of weak prismatic structure

C_g 20-60″ Gray, calcareous, saline silty clay loam

saline and alkali in the subsoil and parent material. A profile diagram and description are given in Fig. 31.

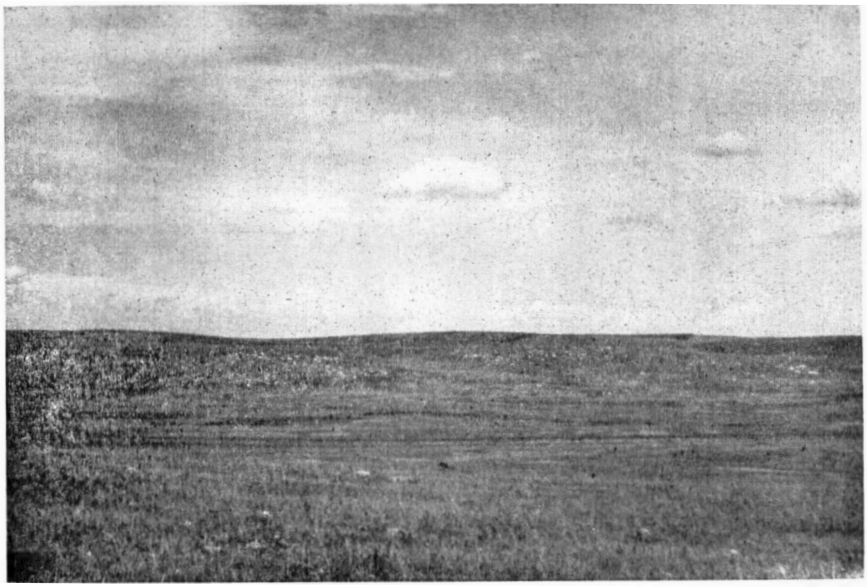
This soil is moderately fertile and has good tilth. It is not subject to water erosion or drifting. It is unsuitable for irrigation principally because of its low-lying position and poor drainage.

Use and Management. Maple silty clay loam is used mainly for pasture and hayland although some of the acreage is cultivated when not too wet. Crop growth is spotty due to saltiness and wetness. These soils will produce greater long time returns when used for pasture and hayland than when cultivated. This soil is in Management Group 18 for hay yield predictions and stocking rates for livestock.

No. 99 Orient-Crandon Complex, Stony, Hilly (10-30%)

This complex consists principally of two shallow, hilly soils, the Orient developed in glacial till and the Crandon developed in outwash. The Orient is described in Fig. 32 and the Crandon in unit No. 32. This complex occurs on hilly areas which consist of a series of steep-sided hills interspersed with areas of gentler relief and scattered sloughs. The Orient and Crandon occur on the hilly areas, the Houdek on the gentler slopes and the Tetonka in the sloughs. The approximate percentage of this complex is: Orient 45 percent, Crandon 25 percent, Houdek 25 percent, and Tetonka 5 percent. The Houdek soil is described in unit No. 67 and the Tetonka soil is described in unit No. 103. Stones are common especially on the Crandon soils. A diagram and description of the Orient are given in Fig. 32.

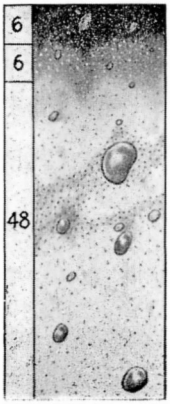
This complex has rather low productivity, is subject to high rates of runoff, and erodes severely when cultivated. It is unsuited for irrigation.



Landscape of Orient-Crandon complex, stony, hilly. These soils are used principally for pasture. The low lying drain in the middle foreground is occupied by the Lamoure soils.

Use and Management. This complex is used for pasture and, where the slopes are not excessive, for hayland. Where so used the composition and quality of the stand can be improved by reseeding with grass-legume mixtures and by controlled grazing. This complex is in Management Group 16 for livestock stocking rates.

Fig. 32. Orient loam



A_1 0-6″ Very dark grayish-brown, friable, mildly calcareous loam of crumb structure

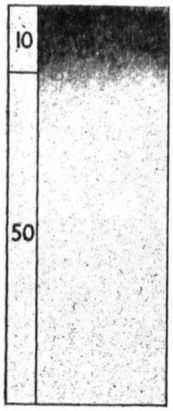
C_{ca} 6-12″ Grayish-brown, friable, strongly calcareous loam

C 12-60″ Light yellowish-brown, friable, calcareous glacial till of loam to clay loam texture

No. 100 Rauville Silty Clay Loam

This is a very poorly drained bottom soil found mainly in abandoned oxbows and other low, wet areas of the James River bottom and its larger tributaries. Many crayfish mounds occur on the soil surface. A profile diagram and description are shown in Fig. 33.

Fig. 33. Rauville silty clay loam



A_1 0-10″ Very dark gray, calcareous silty clay loam

C_g 10-60″ Gray, calcareous silty clay loam containing salt and lime nodules—rust colored spots are common

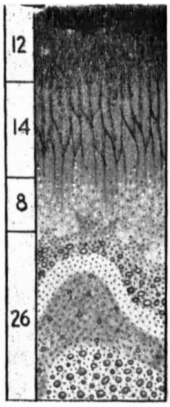
Use and Management. Rauville silty clay loam is too poorly drained to produce any useable vegetation except during a sequence of very dry years. Its best use is as a wildlife habitat.

No. 101 Spottswood Loam, Nearly Level (0-2%)

This is a moderately well drained soil with a medium-textured profile overlying a substratum of coarse sand and gravelly sand. It occurs on smooth, level and nearly level slopes on outwash plains and terraces of streams. It is of limited extent in Spink County and occurs in the southwestern part of the county in Soil Area C (Fig. 3) and in the vicinity of La Delle in southeastern Spink County. There is present, apparently, a deep-lying substrata of fine-textured material which contributes toward a water table in the spring in the Spottswood profile, and which prevents free drainage through the permeable Spottswood profile during the remainder of the year. There may be salts or alkali present in the Spottswood profile or in the coarse substratum. The Spottswood profile has good water-holding capacity and also good permeability. A profile description and diagram are shown in Fig. 34.

Spottswood loam, nearly level is a fertile soil of good tilth. It is not subject to water erosion but is susceptible to blowing. This soil is a good prospect for sprinkler irrigation and a fair prospect for gravity irrigation.

Fig. 34. Spottswood loam



A_1 0-12″ Black, friable loam of granular structure

B_2 12-26″ Dark grayish-brown, friable loam or sandy clay loam of prismatic structure

C_{ca} 26-34″ Light olive brown sandy loam to sandy clay loam

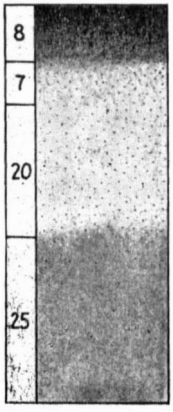
D 34-60″ Olive brown, stratified coarse sand and gravelly sand

Use and Management. Spottswood loam, nearly level is used principally as cropland. Occasionally a high water table in the spring affects the lower lying areas of the soil resulting in poor areation. In some areas the ground water contains soluble salts which when brought up into the soil profile, are of sufficient concentration to depress yields. Pasture and hay crops growing on these sites are usually not adversely affected. This soil is in Management Group 9 for crop yield predictions.

No. 102 Tanberg Loamy Fine Sand

This is a poorly drained sandy soil occurring on large, flat-bottomed depressions in the sandy plain area of Spink County (Soil Area C, Fig. 3). The parent material is sandy outwash or alluvium which has been reworked some by the wind. A profile diagram and description are given in Fig. 35.

Fig. 35. Tanberg loamy fine sand



A_1 0-8″ Very dark gray loamy fine sand

C_g 9-15″ Light gray (when dry) loamy fine sand

C_{ca} 15-35″ Light gray, highly calcareous sandy loam

D 35-60″ Pale olive, calcareous loam

Tanberg loamy fine sand has rather limited fertility. It is subject to drifting but not to water erosion. It is unsuitable for irrigation.

Use and Management. These soils are usually used for hayland and pasture. Where areas are not so poorly drained they are farmed with adjacent better drained soils. When not covered by perennial vegetation this soil needs protection to prevent drifting. This soil is in Management Group 18 for hay yield predictions and livestock stocking rates.

No. 103 Tetonka Silt Loam

This is an imperfectly drained soil occurring in shallow depressions (potholes) in all parts of Spink County except in association with sandy and gravelly soils. The parent material is local wash from higher-lying adjacent soils. The substratum is usually glacial till or lacustrine materials. The profile is friable in the upper part but at depths of from 8 to 14 inches a claypan is encountered. This soil is only slowly permeable but is not saline. A profile diagram and description are given in Fig. 36.

This soil is fertile and has good tilth. It is not subject to either wind or water erosion. It is, however, unsuitable for irrigation because of its low-lying position.

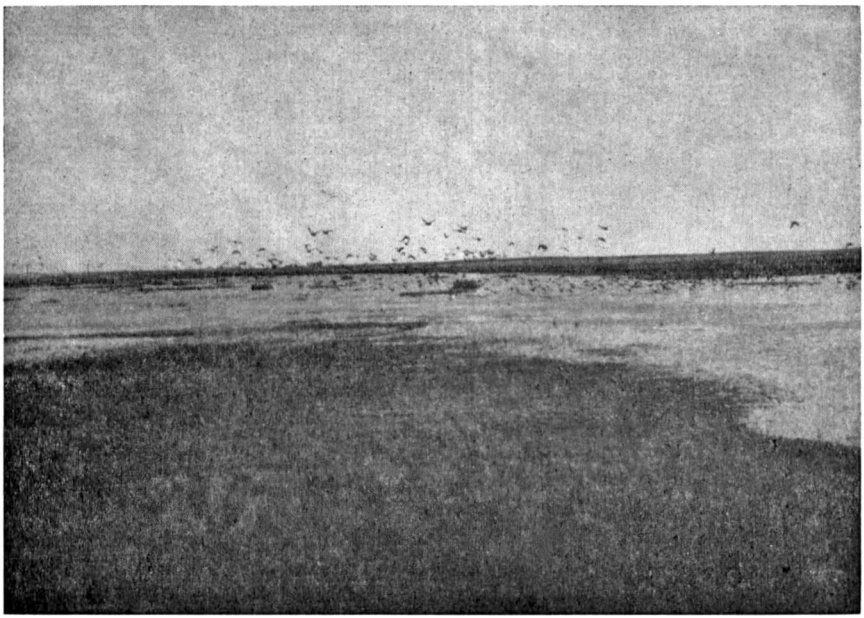
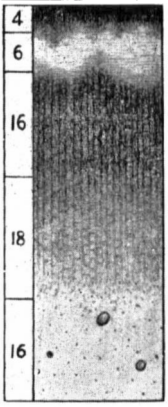


Photo by W. M. Johnson, SCS

Wild ducks on poorly drained Tetonka silt loam. These soils make excellent wildlife habitats.

Fig. 36. Tetonka silt loam



A_1 0-4″ Black, friable silt loam of platy structure

A_2 4-10″ Gray (when dry), friable silt loam of platy structure

B_2 10-26″ Black, firm clay loam of blocky structure

B_3 26-44″ Dark grayish-brown, weak blocky clay loam

C_{ca} 44-60″ Olive gray, calcareous, clay loam glacial till or lacustrine silts and clays

Use and Management. When in small units Tetonka silt loam is farmed with adjacent better drained soils. However, during years of better than average rainfall this soil is usually too wet to farm. During years of average or less moisture this soil can usually be farmed. This soil is in Management Group 17 for crop yield predictions.

No. 104 Tetonka Silt Loam, Poorly Drained

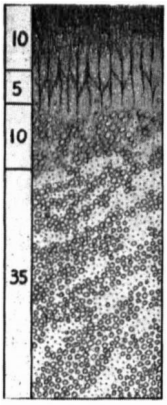
This is a poorly drained soil occurring in depressions (potholes) in all parts of Spink County except in association with sandy and gravelly soils. The soil profile resembles that pictured and described in unit No. 103. When not too wet this soil is moderately fertile and has good tilth. It is not susceptible to erosion. It is not suited for irrigation.

Use and Management. This soil is used mainly for hayland or for pasture. It is usually too wet to cultivate except during a sequence of several dry years. These small potholes usually support several families of ducks and also furnish cover and water for pheasants. For this reason many farmers develop these areas for wildlife. This soil is in Management Group 18 for hay yields and livestock stocking rates.

No. 105 Twin Lakes-Wessington Loams, Nearly Level (0-2%)

This complex consists of two well-drained soils underlain by gravel and sand. In the Twin Lakes soils gravel occurs at about 12 to 20 inches while in the Wessington soil gravel comes in at about 20 to 36 inches. The Twin Lakes soil is described in Fig. 37 while the Wessington profile is described in unit No. 107. This unit occurs in southwestern Spink County in Soil Area C (Fig. 3). This complex occurs on nearly level areas which consist of a plain interrupted by slight rises. Twin Lakes occurs on the rises while Wessington occupies the plain. The approximate percentage compo-

Fig. 37. Twin Lakes loam



A_1 0-10″ Very dark grayish-brown, friable loam of granular or prismatic structure

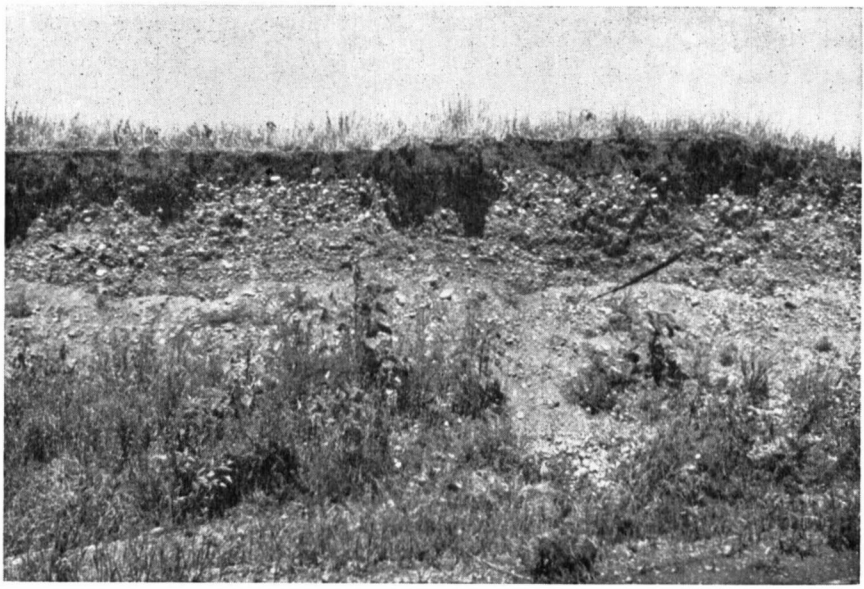
B_2 10-15″ Dark grayish-brown, calcareous loam of prismatic structure

D^{ca} 15-25″ Calcareous, loose gravel and sand with lime incrusted on gravel

D 25-60″ Calcareous, loose gravel and sand

sition of the complex is Twin Lakes 60 percent and Wessington 40 percent. The gravel underlying these soils is about pea-size or smaller. These soils are rapidly permeable and the profiles are free of salts.

This complex has moderate to low fertility. It is subject to moderate drifting but not to water erosion. It is a fair prospect for sprinkler irrigation and a poor prospect for gravity irrigation.



A profile of Twin Lakes loam. These soils are droughty.

Use and Management. This complex is used for hayland, pasture, and cropland. These soils are inclined to be droughty and are susceptible to drifting. Legumes may have trouble maintaining growth over a period of years because of the sand and gravel layer which restricts deep growing roots. This complex does dry up and get warm early in the spring, however, so planting of small grain can be done early. Small grain does better than long season crops like corn. Early maturity will aid in overcoming drought on this complex. This complex is in Management Group 9 for crop yield predictions.

No. 106 Twin Lakes-Wessington Loams, Undulating (3-5%)

This complex resembles unit No. 105 except that it occurs on undulating terrain while unit No. 105 occurs on nearly level areas. This unit is of very limited extent and occurs in southwestern Spink County in Soil Area C (Fig. 3).

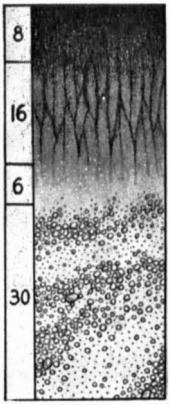
This complex has moderate to low fertility. It is subject to moderate drifting and also to some water erosion. It is a poor prospect for sprinkler irrigation and is unsuitable for gravity irrigation.

Use and Management. This complex is used and managed like unit No. 105. It is in Management Group 9 for yield predictions.

No. 107 Wessington Loam, Nearly Level (0-2%)

This is a well-drained, friable soil which is underlain by gravel at about 20 to 36 inches. This soil is rather limited in extent and occurs in southwestern Spink County in Soil Area C (Fig. 3). The profile is developed in stream deposited sediments which overlie a mixture of coarse sands and pea-sized gravel. The profile and substratum are permeable and nonsaline. The profile is pictured and described in Fig. 38.

Fig. 38. Wessington loam



A_1 0-8″ Very dark brown, friable loam of granular structure

B_2 8-24″ Very dark grayish-brown, friable loam of prismatic structure

C_{ca} 24-30″ Light olive brown, friable loam, strongly calcareous

D 30-60″ Gravelly sand or sandy gravel

This soil is moderately fertile. It is subject to some drifting. It is a good prospect for both sprinkler and gravity irrigation.

Use and Management. Wessington loam, nearly level, is used mainly for cropland, although some is native pasture and hayland. Spring wheat and corn are grown and fair to good yields are obtained in favorable climatic years. This soil tends to be droughty if moisture is limited. It warms up early in the spring so small grain planting can be early. This soil is subject to some drifting so care should be taken to keep a crop or crop residues on the land. This soil is in Management Group 9 for yield predictions.

No. 108 Wessington Loam and Sandy Loams, Nearly Level (0-2%)

This unit is sandier than No. 107, otherwise it resembles it in mode of occurrence and in soil characteristics. This soil also occurs in southwestern Spink County in Soil Area C (Fig. 3). This soil is moderately fertile and has good tilth. It is susceptible to drifting but not to water erosion. It is a good prospect for irrigation.

Use and Management. This soil is used and managed like unit No. 107 except that more care must be taken to prevent soil drifting. This soil is in Management Group 9 for yield predictions.

No. 109 Wessington Loam and Sandy Loam, Undulating (3-5%)

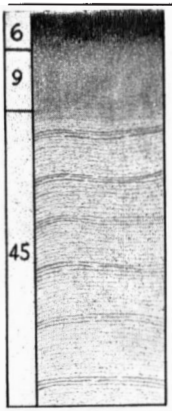
This soil resembles unit No. 107 except that it is sandier and occurs on undulating rather than nearly level terrain. This soil occurs in southwestern Spink County in Soil Area C (Fig. 3). It is moderately fertile and has good tilth. It is susceptible to drifting and to slight water erosion. It is a good prospect for sprinkler irrigation and a fair prospect for gravity irrigation.

Use and Management. This soil is used and managed like unit No. 107 except that more care must be taken to prevent soil drifting. This soil is in Management Group 9 for yield predictions.

No. 110 Zell-Great Bend Silt Loams, Gently Sloping (4-5%)

This complex consists of two gently sloping soils developed in water laid sediments. The Zell is shallow and the Great Bend is moderately deep. The Zell profile is described in Fig. 39 and the Great Bend profile is described in unit No. 46. This complex occurs on the Glacial Lake Dakota Plain, Soil Area A (Fig. 3) principally in the southern part. This complex occurs on gently sloping areas near stream valleys with the Zell occurring on the break while the Great Bend occupies the smooth slope. The approximate percentage composition of the complex is: Zell 55 percent, Great Bend 45 percent. These soils are fairly permeable but may contain slight concentrations of salts in their substrata. A diagram and description of Zell silt loam is given in Fig. 39.

Fig. 39. Zell silt loam



A_1 0-6″ Very dark brown, friable silt loam of granular structure, may be slightly calcareous

C_{ca} 6-15″ Light olive brown silt loam, strongly calcareous

C 15-60″ Light olive brown weakly laminated silt loam, calcareous, may be slightly saline

This complex is moderately fertile and usually has good tilth. It is subject to water erosion. It is a poor prospect for sprinkler irrigation and is unsuitable for gravity irrigation.

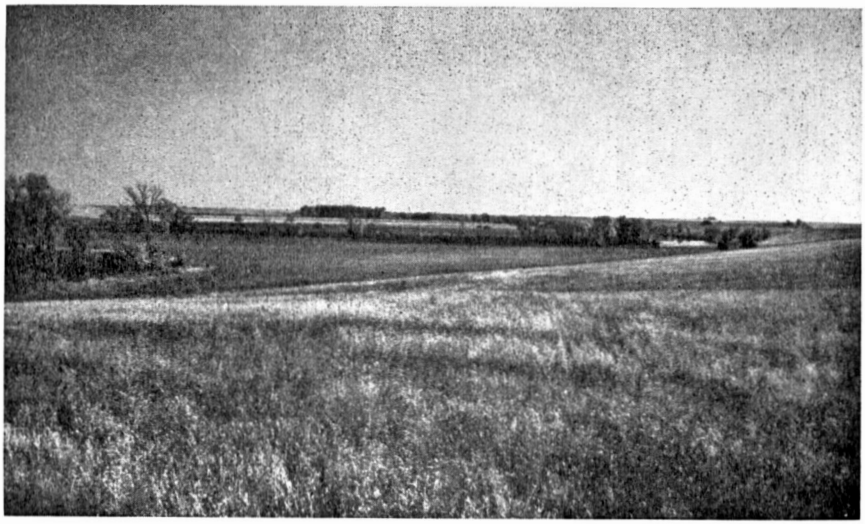
Use and Management. This soil complex is used for pasture, hayland, and for spring wheat and corn. The included soils are both rather shallow so that any erosion is serious. Keeping these soils in perennial vegetation will control runoff and erosion. If cultivated, tillage along the contour will aid in controlling runoff. This complex is in Management Group 11 for yield predictions.

No. 111 Zell-Great Bend Silt Loams, Eroded, Sloping (6-9%)

This complex consists of two sloping soils developed in water laid sediments on the Glacial Lake Dakota Plain. The Zell is shallow and the Great Bend is moderately deep. The Zell profile is described in unit No. 110 while the Great Bend profile is described in unit No. 46. This complex occurs on the sloping areas near stream valleys with the Zell soil occurring on the break while the Great Bend occupies the slope. The approximate percentage of the complex is Zell 60 percent and Great Bend 40 percent. These soils are fairly permeable but may have slight salt concentrations in their parent materials.

This complex has only fair fertility and usually has good tilth. It is subject to severe water erosion if cultivated. It is unsuitable for irrigation.

Use and Management. This soil is used mainly for pasture although some is in hayland and some is under cultivation. The best use for this complex is some type of perennial vegetation because of the steep slopes and shallow soils. It is in Management Group 11 for yield predictions.



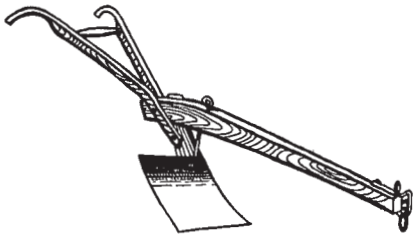
Zell soils are shown on the slope in the foreground. La Delle soils occur in the background on a James River terrace.

No. 112 Zell-Great Bend Silt Loams, Eroded, Steep (10-30%)

This complex resembles unit No. 111 except that it occurs on steep breaks rather than sloping areas. The composition of the complex varies slightly from that given for unit No. 111 in that about 65 percent of this unit is Zell and 35 percent is Great Bend. In mode of occurrence and in soil characteristics this soil unit is similar to unit No. 111.

This complex has low fertility. It is subject to severe erosion if cultivated. It is unsuitable for irrigation.

Use and Management. This complex is used principally for pasture. When used for hayland or cultivated it is rather steep for the use of machinery. When cultivated this soil unit erodes seriously. When used for pasture the stand can be improved by reseeding with legumes and grasses and by controlled grazing. This complex is in Management Group 16 for stocking rates.



USE, MANAGEMENT, AND PRODUCTIVITY OF THE SOILS OF SPINK COUNTY

THE USE, management, and productivity of the soils of Spink County are discussed in five main parts. The first part is a general discussion of some practices and principles of soil management. In the second part the soils are grouped on the basis of those properties that have the greatest influence on management.

The third part, dealing with the productivity of the soils, gives estimated yields that might be expected of the more important crops over many years under defined systems of management. For these yield predictions the soil types and phases described earlier have been placed into 19 management groups and the yields are given for each group. The yield predictions are given for unfavorable, favorable, and very favorable growing conditions. These growing conditions are defined in the introductory material for part three. In addition, the yields given are for four sets of management practices. This will allow the reader to calculate the advantage that there might be in using a management system other than the one he is now following.

The fourth part of this section rates the soils in the 19 management groups according to their relative productivity for the various crops grown in the county. This material is supplemental to the yield predictions shown in part three and shows how the yields given for Spink County soils compare with those on soils considered the most productive for the crop in the United States as a whole. The fifth part of this section shows in table form the potential irrigability of the soils of Spink County.

Farmers consider many factors in planning the organization and management of their farms. Besides the soil resources of the farm, other factors which are important are the likes and abilities of the farmer and his family; his financial resources and obligations; the livestock, equipment, machinery, and buildings available; the cost of additional machinery and equipment; and the price of the products that can be produced. These factors differ among farms and farmers. Each farmer, therefore, must prepare the plans of organization and management of his farm for a set of conditions which differ somewhat from those of other farms. The farmer must decide what use to make of his soil resources and what level of productivity is practical. To make these decisions wisely, the farmer must know the various crops and grasses that may be grown on his farm, and the productivity of his soils for these alternative crops under different systems of management and climate.

The productivity of a soil depends upon a large number of factors which include (1) its characteristics, (2) the climate, and (3) the

management it receives. Soil characteristics and climatic conditions are hard to change and must be used as they are. Management, however, is subject to control. Changes in a system of management can drastically change the yield and quality of the crops produced.

Soil Management Practices and Principles

A system of soil management consists of a combination of many practices, such as crop rotation, application of fertilizers, and wind strip cropping. Each combination will produce different kinds and amounts of crops although several combinations may produce similar results.

The effectiveness of any one management practice is dependent upon other practices of the system. For example nitrogen fertilizer will not usually increase corn yields on Beotia silt loam if a legume has been raised immediately preceding. Some important practices which can be a part of a system and some of the important principles to be followed in choosing practices are discussed in this section.

Crop Rotations. Crop rotation consists of growing different crops in recurring succession on the same piece of land. Alternating wheat and corn on the same piece of ground is an example of a crop rotation. This rotation will help control weeds and some diseases. However, the continued production of wheat and corn lowers the content of organic matter and plant nutrients in soils and brings about a gradual deterioration of soil tilth. To maintain soil organic matter, fertility, and soil tilth, and to aid further in weed, diseases, and insect control, it is usually necessary to grow crops other than corn and small grains in a rotation.

Legumes and grasses are used in rotations with corn and small grain. These crops are close-growing and have beneficial effects on the soil. Organic matter is added and the content of plant nutrients (especially nitrogen) is increased. The extensive root systems of these crops improves soil structure and tilth. These improvements result in increased yields of small grains and corn.

Besides adding organic matter and plant nutrients to soils and improving soil tilth, rotations are an aid in controlling weeds. With the exception of noxious weeds, which are perennials, most weeds are annual plants which must depend on their seeds for reproduction. Cutting these weeds close to the ground before the seeds ripen destroys them. Several opportunities to do this occur in a rotation of row crop, small grain, and legume. Winter rye and legumes, especially alfalfa, can compete with noxious weeds and weaken them.

The selection of rotations for a farm is made on the basis of the nature and pattern of the soils and the organization of the farm. A rotation suitable for Beotia silt loam probably would not give good results on Exline silty clay loam complex. A rotation that would be feasible for a well-stocked, well-equipped farm would not be satisfactory for one

having little livestock and less machinery. The simplest and most economical layout for a farm is one where the fields are of uniform soil and nearly equal size.

Crops used in rotations in Spink County can be divided into three classes: grain crops, row crops, and grasses and legumes. The grain crops are principally spring wheat, oats, barley, and rye. The row crops are corn and sorghum. The different kinds of legumes and grasses are numerous and include alfalfa, sweet clover, bromegrass, crested wheatgrass, and Ree wheatgrass. These crops have an effect on each other in a rotation. Corn, wheat, and a legume work well together, because corn usually leaves a residue of moisture in the soil for the wheat. Wheat makes an excellent nurse crop for alfalfa or sweet clover, and when these legumes are plowed under they add nitrogen to the soil for the corn which follows.

The crop yields in part three of this section are given for four systems of management designated A, B, C, and D. In System A and B the rotations used are row crop—small grain. System B utilizes commercial nitrogen fertilizer, while System A does not. System C is an alfalfa-grass rotation with row crops and small grain, while System D is a sweet clover-grass rotation with row crops and small grain. Systems A, B, and D are principally for farms without livestock. System C furnishes hay for livestock. Under System A soil productivity will be low. Systems B, C, and D all result in good yields of crops and allow the farm operator to choose whether he wants to buy fertilizer in a bag (System B) or get it from legumes (Systems C and D).

Considerable flexibility is possible in a rotation without materially changing soil productivity. For example different small grains can be interchanged and sorghum can be substituted for corn without much influence on productivity. Changes between groups, however, such as corn for sweet clover, may markedly change productivity. Minor changes in a rotation are often necessary as circumstances of the market and farm shift. Additional information on rotations can be obtained from the county agent and from South Dakota State College.

Maintaining Organic Matter. Organic matter serves as a storehouse for plant food elements, especially nitrogen and phosphorus; serves as food for useful microorganisms; and as a sponge for absorbing and holding moisture. It also improves the structure and permeability of soils.

Before these soils were farmed a balance was established between the organic matter added by native vegetation and that decomposed by microorganisms. When brought under cultivation the content of organic matter decreased. At the present time these soils are losing an average of about one half of 1 percent per year of organic matter according to South Dakota Circular 92. This loss occurs because part of each crop is removed from the land. In addition, cultivation tends to promote more rapid decomposition of organic residues. If crop yields are

to be held at a satisfactory level it is necessary to replenish and maintain a supply of organic residues in the soil.

Organic matter may be added to the soil by plowing under crop residues, adding barnyard manure, using green manure crops, and growing grass-legume mixtures for some period in the rotation.

All crop residues except those harboring diseases and insect pests should be returned to the soil. Burning straw is a poor practice from the standpoint of fertility maintenance. Straw from a 15-bushel crop of wheat contains about 15 pounds of nitrogen.

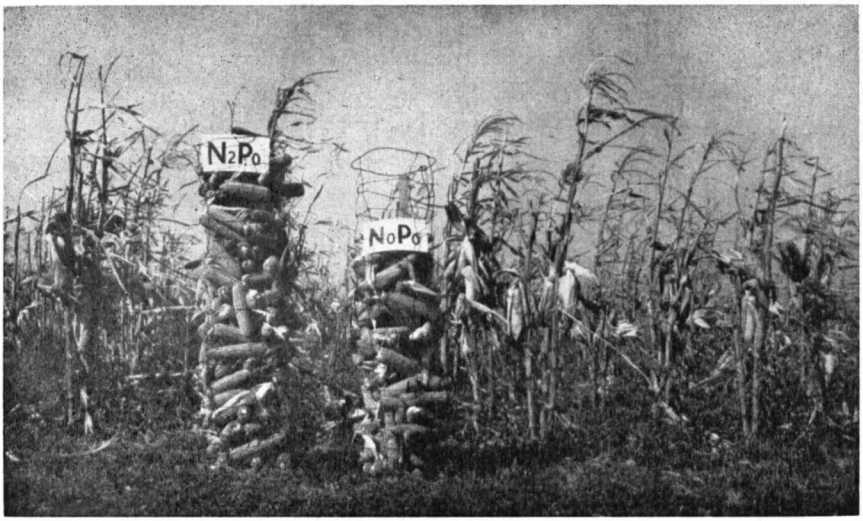
Barnyard manure supplies plant food elements, including trace elements, besides improving permeability and structure in soils. A ton of manure contains about 10 pounds of nitrogen, 5 pounds of phosphorus, and 10 pounds of potash.

Sufficient quantities of manure are not always available for necessary application to fields especially on grain farms where very little may be on hand. To maintain organic matter in soils on these farms it is necessary to use green manure crops or grasses and legumes in rotations to provide organic residues. Legumes are the best green manure crops. When inoculated they obtain a large part of their nitrogen from the air and thus, when plowed under, add considerable nitrogen to the soil. Alfalfa can return as much as 80 pounds per acre of nitrogen to the soil when the second cutting of a 3-year stand is plowed under. Alfalfa will not add much additional nitrogen to the soil after the second or third year.

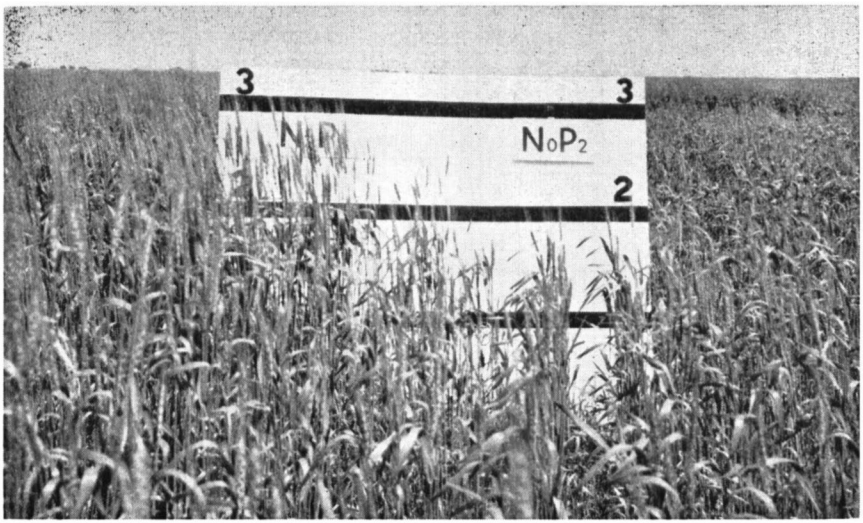
The amount of nitrogen fixed by sweet clover depends on the amount of growth it makes the first fall and the following spring. A 14 inch growth plowed under can return as much as 30 pounds of nitrogen per acre. For every ton of sweet clover plowed under, approximately 50 pounds of nitrogen is added to the soil. It takes about 35 pounds of nitrogen to produce a 15-bushel crop of wheat and 37 pounds of nitrogen to produce a 25-bushel crop of corn.

Grasses and legumes improve soil structure besides adding organic matter. Grasses especially are beneficial with their well-distributed, fibrous root systems which tend to form a porous, well-aerated soil. Improved soil structure and increased organic matter are a means of preventing serious soil erosion. Additional information on maintaining organic matter in soils can be obtained from the county agent and from South Dakota State College.

Plant Nutrients and the Use of Commercial Fertilizers. Nitrogen, phosphorus, and potassium are used in rather large amounts by growing plants. Deficiencies of these elements will reduce crop yields and quality. At the present time in Spink County soils, nitrogen especially, and phosphorus are the only elements likely to be deficient. These plant nutrients, as well as those of less importance, are lost from the soil in several ways. Plant nutrients are removed from the soil by cropping, erosion, and leaching.



Results of a fertility test plot for corn on Hecla loamy fine sand, till substratum. The grain in the container on the left was fertilized with 40 pounds per acre of nitrogen. The grain in the container on the right had no fertilizer. The fertilized corn yielded 13.2 bushels per acre more than the unfertilized.



Fertility test plot for wheat on Beotia silt loam. The picture was taken on June 30, 1953. The grain on the left was fertilized with 40 pounds per acre of nitrogen and 20 pounds per acre of phosphorus. The grain on the right was fertilized with 40 pounds per acre of phosphorus. The grain on the left yielded 12.2 bushels per acre, that on the right yielded 5.2 bushels per acre. The year of this experiment—1953—was a bad rust year.

Losses by cropping depend upon the type of crop grown and the yield. For example, a 15-bushel-per-acre crop of wheat removes from the soil about 35 pounds of nitrogen, 6 pounds of phosphorus, and 17 pounds of potassium, while a 25-bushel crop of corn removes about 37 pounds of nitrogen, 7 pounds of phosphorus, and 17 pounds of potassium.

Plant nutrient losses by erosion vary with the kind of soil and the type of management it receives. Beotia silt loam on level terrain is not susceptible to water erosion and hence does not lose plant nutrients in this manner. Great Bend silt loam which is a sloping soil is subject to water erosion and does lose plant nutrients in this way if control measures are not taken to prevent it.

Loss of plant nutrients by leaching is not great in Spink County except from sandy soils.

Plant nutrients which are lost from soils may be replaced several ways. The soil itself is a partial source of replacement for plant nutrients. Nitrogen is transformed into a form available to plants by the activity of microorganisms on more resistant organic residues. Potassium, calcium, phosphorus, and magnesium are released from soil minerals by weathering and in this way are made available to plants.

A second source of replacement of plant nutrients in the soil is the atmosphere. Nitrogen is the only element replaced in this manner. Certain microorganisms have the ability to fix nitrogen on the roots of legumes or directly in the soil and in this way nitrogen is taken from the atmosphere and placed in the soil. In Spink County, alfalfa can return as much as 80 pounds per acre of nitrogen to the soil when the second cutting is plowed under during the third year.

A third source of nutrients is manure and commercial fertilizers. Manure adds small quantities of many nutrient elements. Commercial fertilizers can be made up to contain any combination of elements, but for Spink County those which contain nitrogen and phosphorus are all that are needed. The amount and kind of commercial fertilizer to use varies with the type of soil and its cropping history, and the type of crop grown.

Generally the thinner, undulating soils like Houdek loam and the sandy soils like Hecla are more responsive to nitrogen fertilizer than are the deep, nearly level soils like Beotia, Beadle, and Bonilla. Soils which have been heavily cropped to small grains and corn without the return of manure, crop residues, or green manure crops, usually are low in nitrogen.

Commercial Fertilizers in Corn Production. Nitrogen is the most deficient plant nutrient in corn production. Nitrogen fertilizer however, will not appreciably increase corn yields if corn is preceded by a legume, a fallow period, or manure applications. If growing conditions are favorable, 2 to 3 pounds of nitrogen will increase the yield of corn 1 bushel up to the applications of 40 pounds per acre on depleted soils.

Although the lack of phosphorus occasionally reduces corn yields and retards maturity, if applied without meeting nitrogen requirements, phosphorus applications do not pay.

For corn usually the best method of applying small quantities of fertilizers (10 to 20 pounds of available nutrients) is with a fertilizer attachment on the corn planter. Large quantities of fertilizer may be applied by broadcasting and then disked or plowed under. Straight nitrogen fertilizer may be broadcast or side dressed at the time of the second cultivation or earlier. Because there is always the chance that no rain will fall to dissolve the nitrogen and take it down to the plant roots, plowing under of fertilizer usually will give best results.

Commercial Fertilizers in Small Grain Production. Nitrogen is the most deficient plant nutrient in small grain production. If small grain is in a legume rotation, or was preceded by manure applications or a fallow period, nitrogen fertilizers will not appreciably increase small grain yields. Although a mixed fertilizer containing both nitrogen and phosphorus sometimes gives yield increases over those received for nitrogen alone, applications of phosphorus alone seldom give satisfactory yield increases. If growing conditions are favorable, 2 to 2½ pounds of nitrogen will increase the yield of wheat 1 bushel, and 1½ to 2 pounds of nitrogen will increase the yield of oats 1 bushel. These yield increases are for applications of fertilizer up to about 35 pounds per acre on depleted soils.

For small grain the most efficient method of applying fertilizers is with a fertilizer attachment on the drill. The fertilizer can also be broadcast and then lightly disked or harrowed in or plowed under. Straight nitrogen fertilizer may be broadcast as a top dressing to fall sown grains early in the spring. It has been found that 20 to 30 pounds per acre of nitrogen are the best rates for average conditions.

Commercial Fertilizers for Legumes and Grasses. Phosphate fertilizer may be applied to legumes at rates ranging from 20 to 40 pounds of available phosphate per acre. Nitrogen fertilizers, are unnecessary on inoculated legumes which have atmospheric nitrogen fixed in root nodules by microorganisms.

Grasses when grown alone are very responsive to nitrogen fertilizers. On most soils very substantial yield increases in seed and forage will be obtained by the use of nitrogen fertilizer alone. Phosphorus when applied with nitrogen may give some yield increase over that obtained from nitrogen alone. This is especially true for soils like Zell, Hamerly, and Lamoure which are limy near the surface. Twenty to thirty pounds of nitrogen per acre is a satisfactory rate of application of fertilizer on grass. Established stands of grasses and legumes can be fertilized by broadcasting early in the spring or during late fall.

Soil Testing Service. A soil testing service is maintained at the Agronomy Department at South Dakota State College. Samples of soil can

be sent to this laboratory and analyzed to determine their available nutrient supply. Additional information on soil testing and also on the use of commercial fertilizers can be obtained from the county agent and from South Dakota State College.

Tillage. The primary purposes of tillage are to prepare the seed bed, to make the soil receptive to water, to control weeds, and on soils which do not drift, to incorporate organic residues and fertilizer into the soil. Where a wind erosion hazard exists, tillage should be by tools which tend to raise big clods and leave as much crop residue as possible on the surface. Among these tools are the lister, the subsurface tiller, the chisel, the duckfoot cultivator, and the wheatland plow.

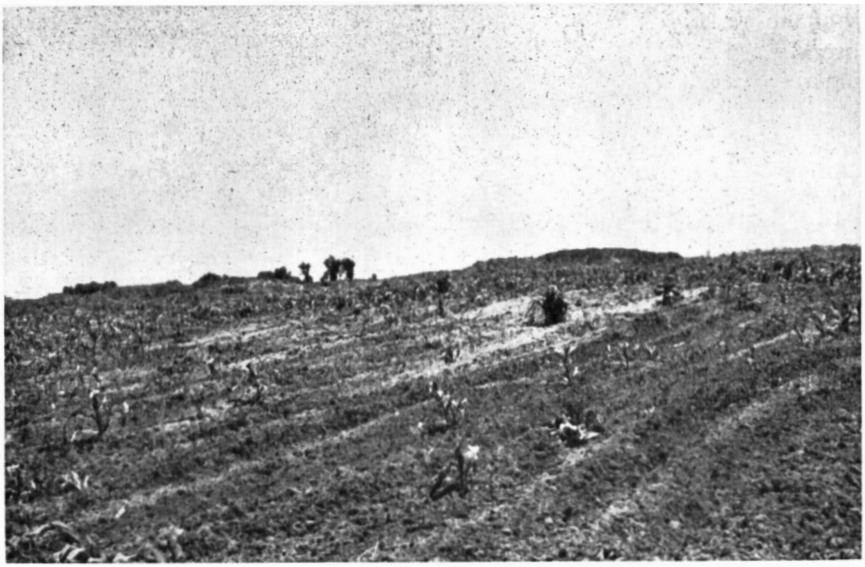
The moldboard plow is used extensively in Spink County. This implement is desirable under cropping systems which include grasses and legumes and on soils like Aberdeen and Bonilla which will clod leaving the surface rough. When used on sandier soils like Hecla where a cloddy surface is hard to maintain throughout the period when the soil is not covered by vegetation, its use may permit excessive soil drifting.

Practices for Control of Wind Erosion. Wind erosion has been a serious problem in Spink County and can be again. Although caused by drought, which is beyond man's control, the extent of damage depends largely on how the soil has been managed. There is of course, a difference among soils in their resistance to the wind, but no soil is immune when drought strikes. Sandy soils like Hecla are very susceptible and usually begin to blow soon after they are plowed. Medium and finer textured soils like the Houdek, Beotia, and Aberdeen, generally are more resistant.

Before discussing the practices and principles of wind erosion control it may be well to examine the effect of soil blowing on a field. Soil containing approximately 60 percent of sand grains or granules the size of sand grains are very liable to blow while those containing less than 40 percent usually do not blow easily. The wind needs a run of a few hundred yards to build up a body of moving soil grains. At the windward end of the area the sand tends to accumulate while the finer particles may be carried hundreds of miles as dust. The silt size soil grains are deposited at the outer fringes of the area.

The primary problems of wind erosion control are concerned with bare or partially bare soil, because soil well covered with vegetation will not blow. Where the soil is used for wheat and corn production the land will carry no crop when a series of dry years occurs. The soil, which has been depleted of organic matter is then helpless before the wind. In ranching operations serious overgrazing is likely to accompany a period of dry years and this too will leave large areas of the soil almost bare.

The principle of all methods of controlling soil blowing is to prevent the building up of a sufficiently



Hummocky, wind eroded area of Maddock-Hamar loamy fine sands. Corn crop is very poor and soil is left bare inviting further drifting.

high density of moving sand grains. This can be done either by (1) trapping the moving grains before they become dense, (2) reducing the velocity of the wind to prevent it from picking up sand grains, or (3) covering the soil with vegetation.

Practices used to trap moving sand grains include planting alternate strips of grasses and legumes with crops of corn and wheat, the strips running across the direction of the prevailing winds.

The velocity of the wind can be reduced by planting shelterbelts, but the climate is often too dry for most trees to grow quickly. Planting trees in subsoil furrows on land that has been fallowed aids greatly in the survival of stands. Stands should be cultivated until the canopy is closed. The area affected by the shelterbelt is limited to about 5 times its height on the windward and 20 to 30 times its height on the leeward side.

Suitable cultivation can also reduce the chance of wind picking up sand grains. Leaving a cloddy surface will result in no loose sand particles of a suitable size to pick up. Laying the soil in ridges will reduce drifting by preventing the build-up of moving sand grains. Stubble mulch cultivation is another effective measure to use in wind erosion control. The previous year's stubble is left anchored on the surface which protects the soil. In Spink County where much of the harvesting of wheat is done by combine a long stubble can be left. This stubble plus the straw left from the combine will greatly reduce the veloc-

ity of the wind at ground level and lessen the chance of sand grains moving. Research has shown that as little as one-fourth of a ton per acre of straw on the soil surface has an appreciable effect on reducing soil drifting.

These practices will give good control of soil drifting in most years, but possibly there will be years in Spink County, as there have been in the past, when good farming practices will be insufficient to stop soil blowing. When crops fail generally there are emergency measures which may be used to hold the soil.

Smooth fields without a protective cover should be watched and when blowing starts emergency tillage is all that can be depended upon to hold the soil. In medium and fine-textured soils like Houdek and Aberdeen the lister may be used. The important thing is to lift clods to the surface. Tillage should be at right angles to the prevailing wind. On sandy soils the lister is usually of little value because the soil does not clod. When a field is hard or when it has been coated with a few inches of soil from previous drifting, and the lister does not bring up large clods, then deep chiseling may be better than listing.

Other tillage implements, including the moldboard plow, harrows, and cultivators may be used if the drifting hazard is not great. The main concern is to leave the surface condition rough.

These emergency measures are expensive but at times they may be necessary. After drifting has been stopped by emergency tillage, every effort should be made to get a vegetative cover on the land. On severely eroded land with small sand hummocks, alternate rows of rye and grass may be planted. On land where sand has drifted into large hummocks, extreme measures are necessary to prepare the soil for seeding. The lister can be used on areas surrounding the hummocks. The lister furrows provide traps to catch sand and moisture. Sorghum and Sudan grass, which have low water requirements, can be planted later in the furrows if sufficient moisture is obtained. Sorghum can be planted as late as July 1 and still provide a cover crop. When a vegetative cover is restored, these areas can be seeded to grass.

Practices for Control of Water Erosion. Spink County is one of the flattest counties in South Dakota. In Soil Area A (Fig. 3), which is the Glacial Lake Dakota Plain, the only slopes are those along the stream valleys of the James River and its largest tributaries. Where fairly steep and long, these slopes are susceptible to water erosion. These areas are occupied by the Great Bend and Zell soils principally, and the practices suited to these soils for control of erosion are contour cultivation, contour strip cropping, and the seeding down of waterways.

Soil Areas B, D, and E (Fig. 3), are undulating plains which have short slopes and usually extremely irregular topography. These areas are occupied by the Houdek, Bonilla, and Beadle soils principally. Contour erosion control practices are very difficult to apply on these

undulating soils. Moreover water erosion is usually confined to the small knolls and knobs and is not widespread over the entire landscape. The water erosion control practice best suited to these soils is the use of permanent vegetation on the eroded spots.

Water erosion is usually not a serious problem in the sandy plain area of the county, Soil Area C (Fig. 3). The Hecla and Wessington soils which occur in this area usually absorb all the rain which falls on them.

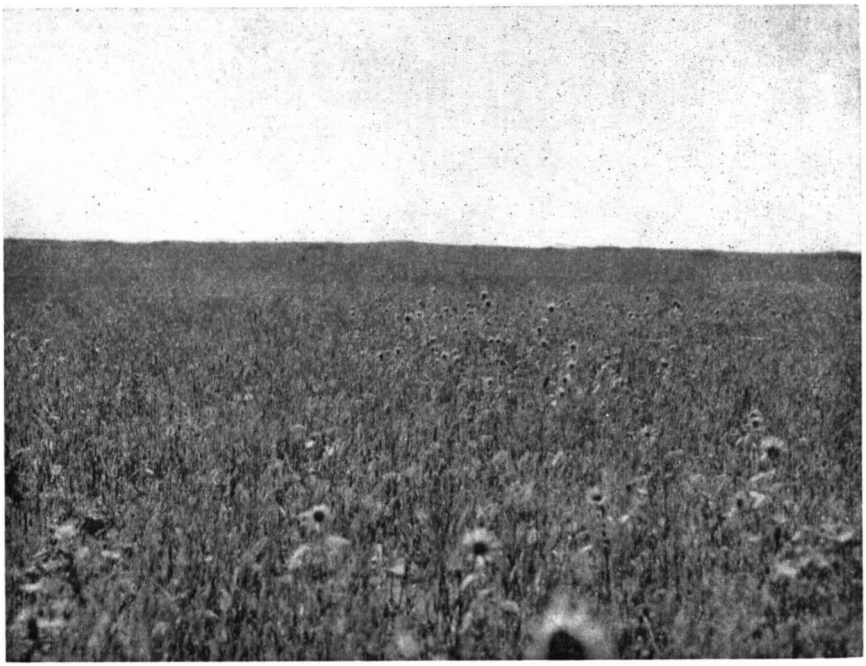
Generally speaking, soils in which the fertility has been maintained at a high level by the use of good rotations are much less susceptible to erosion than are those in which fertility has been depleted. This is because crops on fertile soils are vigorous, and the soils themselves are more permeable and less subject to movement by water. Additional information on practices for control of wind and water erosion can be obtained from the county agent, the Soil Conservation Service, or South Dakota State College.

Moisture Conservation and Weed Control. With minor exceptions precipitation is the only source of water for crop production in Spink County. The exceptions are on soils along streams where water may be near enough to the surface to be reached by deep rooted crops like alfalfa, and in areas where irrigation water may be used.

Crops need large amounts of water to see them through maturity. For example about 550 pounds of water are required to produce a pound of dry matter for wheat, while about 840 pounds of water are necessary to produce a pound of dry alfalfa. Crop yields depend to a large extent on how efficiently water is used. There are two principal ways to make more efficient use of water: (1) increase the amount of available water; and (2) prevent water loss because of weeds and runoff.

The amount of water available to a particular crop can be increased by growing the crop after corn or sorghum which leave a reserve of moisture, or by fallows or partial fallows. In Spink County the carry-over of water from corn and sorghum is about the same and is roughly half of the carry-over which results from summer fallow.

Summer fallow sacrifices one crop to store moisture for the next. To be effective, summer fallow tillage must be such that weeds are destroyed and at the same time the surface condition must be left resistant to runoff and to wind erosion. Where soil drifting is a problem the plowless fallow can be used. Here the land is worked with a duckfoot cultivator or some other implement which destroys weeds but does not turn under the stubble. Because a large part of the precipitation in Spink County falls when air and soil temperatures are high and humidity low, it is possible to store only about 20 to 25 percent of the precipitation by summer fallowing. For fallow to be an economic practice it must substantially increase yields, as no return is received from the portion of the land being fallowed. In Spink County where a much larger acre-



Sunflowers and pigeon grass have robbed this wheat crop of needed moisture. Soil type is Groveland fine sandy loam.

age is in spring, rather than fall-sown grain, the usual practice is to plant a row crop rather than leave the land in summer fallow. The row crop will leave about half as much carry-over moisture as the fallow and in addition will provide income from the land.

A partial fallow used after a legume has been plowed under is a good practice. In a rotation of spring wheat-sweet clover fallow-corn, the sweet clover is plowed under in the spring after it has attained a growth of about 6 to 8 inches and before it has exhausted the soil of moisture. The land is then kept free of weeds and in a condition to prevent runoff and wind erosion until corn is planted the following spring. Fallowing is of little or no value on sandy soils like the Hecla, on shallow soils like the Zell and Orient, and on fine-textured soils like the Exline.

Moisture dissipation by weeds is a source of serious water loss in Spink County. One principle of weed control is to plant clean seed. Once weeds are established there are cultural and chemical methods of control. Cultural methods are cheaper than chemical methods and in most cases are effective. They include the use of good rotations and the use of competing crops. A high level of fertility in the soil aids in

weed control also. Wheat on a fertile soil will tend to stool out more, grow faster and get ahead of weeds and smother them.

In a crop rotation such as corn-wheat-alfalfa several opportunities occur to cut weeds close to the ground before they produce seed. This method of control will work on most annual weeds although wild oats and crab grass may survive this treatment.

Noxious weeds are perennials with spreading or creeping root systems or with underground parts which are uninjured by tillage. Cultural methods for control include growing competitive crops, raising an intertilled crop, or intensive cultivation. Competitive crops include alfalfa, sweet clover, winter rye, close drilled sorghum, and Sudan grass. Cultivating checked corn provides more opportunity to weaken noxious weeds than does cultivating drilled corn. If fallowing is used, cultivation every 2 or 3 weeks is effective in weed control. Additional information on weed control can be obtained from the county agent or from South Dakota State College.

Soil Groups with Similar Management Problems

The soils have been divided into 19 groups, each group being generally similar in management problems and in productive capacity. The soil properties used in placing the soils into these groups were slope, natural drainage, texture, and in some cases the presence or absence of a claypan.

Management Group 1, Nearly Level To Undulating, Well-Drained, Coarse-Textured Soils

The soils included are:

No. 61 Hecla loamy fine sand, nearly level (0-2%)
No. 62 Hecla loamy fine sand, till substratum, nearly level (0-2%)
No. 63 Hecla-Hamar loamy fine sand, nearly level (0-2%)
No. 64 Hecla-Hamar loamy fine sand, wind eroded, hummocky (0-2%)
No. 95 Maddock sandy loam, undulating (3-5%)
No. 96 Maddock loamy fine sand, till substratum, undulating (3-5%)
No. 97 Maddock-Hamar loamy fine sand, wind eroded, hummocky (3-5%)

Principal Management Problems. The control of wind erosion and the maintenance of organic matter and soil fertility are the principal management problems of this group of soils. These soils are extremely susceptible to drifting. Because these soils are sandy they do not clod well, and it is difficult to leave the soil surface in a condition rough enough to control drifting. In most cases to get control it is necessary to keep this group of soils in some type of perennial vegetation, or the choice and sequence of crops should be so arranged that the field will be protected by either a growing crop or crop residues throughout the year. Stubble mulch tillage is a good practice on these soils. Wind strip cropping is likewise a good practice but the intertilled portions must be watched so they do not drift into the crop strips. Deep chiseling may be used to help control drifting in these soils when they are bare. Organic matter can be maintained in these soils by including legumes in the rotation.

Management Group 2, Nearly Level, Well-Drained, Moderately Coarse-Textured Soils

The soils included are:

No. 26 Bonilla-Houdek fine sandy loams, nearly level (0-2%)
No. 27 Bonilla-Houdek fine sandy loams, firm till substratum, nearly level (0-2%)
No. 28 Bonilla-Groveland fine sandy loams, nearly level (0-2%)
No. 43 Eckman fine sandy loam, nearly level (0-2%)
No. 59 Hecla sandy loam, nearly level (0-2%)
No. 60 Hecla sandy loam, till substratum, nearly level (0-2%)

Principal Management Problems. The control of wind erosion and the maintenance of soil organic matter and fertility are the principal management problems for this group of soils. Wind strip cropping and stubble mulch tillage are adapted practices to prevent drifting of these soils under favorable climatic conditions. If climatic conditions become unfavorable and there is no cover on the land, deep chiseling will help hold the soils. Fertility and organic matter can be maintained by growing legumes in the rotation.

Management Group 3, Nearly Level, Well-Drained, Medium-Textured Soils

The soils included are:

No. 15 Beotia silt loam, level (0-1%)
No. 16 Beotia silt loam, moderately saline substratum, level (0-1%)
No. 17 Beotia silt loam, till substratum, level, (0-1%)
No. 18. Beotia silt loam, nearly level (2-3%)
No. 19 Beotia silt loam, moderately saline substratum, nearly level (2-3%)
No. 20 Beotia silt loam, till substratum, nearly level (2-3%)
No. 22 Beotia silt loam, valley phase, nearly level (0-2%)
No. 23 Bonilla-Houdek loam, nearly level (0-2%).
No. 24 Bonilla-Houdek silt loams, nearly level (0-2%)
No. 25 Bonilla-Cresbard silt loams, nearly level (0-2%)
No. 34 Cresbard-Bonilla silt loams, nearly level (0-2%)
No. 35 Doland silt loam, nearly level (0-2%)
No. 36 Doland silt loam, loamy fine sand substratum, gently sloping (3-5%)
No. 37 Doland silt loam-Solonetz complex, nearly level (0-2%)
No. 38 Eckman loam, nearly level (2-3%)
No. 39 Eckman loam, level (0-1%)
No. 42 Eckman loam, valley phase, nearly level (0-2%)
No. 47 Great Bend silt loam, nearly level (2-3%)
No. 48 Great Bend silt loam, level (0-1%)
No. 50 Great Bend silt loam, till substratum, nearly level (2-3%)
No. 54 Hand-Houdek loams, gently undulating (1-3%)
No. 86 La Delle silt loam, level (0-1%)
No. 87 La Delle silt loam, nearly level (2-3%)

Principal Management Problems. The soils in this group are considered to be among the best in Spink County and can be kept at a high level of productivity by maintaining organic matter and a supply of available nitrogen by inclusion of a legume in the rotation.

Management Group 4, Nearly Level, Well-Drained, Moderately Fine-Textured Soils

The soils included are:

No. 6 Beadle silt loam, nearly level (0-2%)
No. 7 Beadle silt loam, stony, nearly level (0-2%)
No. 8 Beadle silt loam, nonsaline substratum, nearly level (0-2%)
No. 9 Beadle silt loam, stony, nonsaline substratum, nearly level (0-2%)

No. 13 Beadle-Cresbard silt loams, nearly level (0-2%)
No. 14 Beadle-Houdek-Cresbard silt loams nearly level (0-2%)
No. 33 Cresbard-Beadle silt loams, nearly level (0-2%)
No. 55 Harmony silty clay loam, level (0-1%)
No. 56 Harmony silty clay loam, nearly level (2-3%)
No. 57 Harmony silty clay loam, till substratum, level (0-1%)
No. 58 Harmony loam, level (0-1%)
No. 88 La Delle silty clay loam, level (0-1%)
No. 90 La Delle-Northville silty clay loams, level (0-1%)
No. 91 La Delle-Northville silt loams, level (0-1%)

Principal Management Problems. Maintaining organic matter and a supply of available nitrogen, and providing for good tilth, are the principal management problems on these soils. On some of the included Beadle soils stones will need to be removed if the soils are to be conveniently cultivated. Legumes will supply a source of available nitrogen and also aid in maintaining tilth because of added organic matter.

Management Group 5, Nearly Level, Imperfectly Drained Sandy Soils with Claypans

The soils included are:
No. 65 Hecla-Letcher loamy fine sand, nearly level (0-2%)
No. 66 Hecla-Letcher sandy loam, nearly level (0-2%)

Principal Management Problems. The soils included in this group have several serious management problems. Having sandy surface horizons makes these soils susceptible to wind erosion and low in plant nutrients. The claypan subsoil is rather impermeable to plant roots and to moisture, and in addition it is poorly aerated. Because of the hazards to cropping which exist on these soils, their best use is in perennial vegetation.

Management Group 6, Nearly Level, Imperfectly Drained, Moderately Fine Textured Soils with Claypans

The soils included are:
No. 1 Aberdeen silty clay loam, level (0-1%)
No. 2 Aberdeen silty clay loam, nearly level (2-3%)
No. 3 Aberdeen silty clay loam, till substratum, level (0-1%)
No. 4 Aberdeen loam, level (0-1%)
No. 5 Aberdeen-Harmony silty clay loams, level (0-1%)
No. 12 Beadle-Cavour silt loams, nearly level (0-2%)
No. 29 Cavour-Beadle silt loams, nearly level (0-2%)
No. 30 Cavour-Houdek loams, nearly level (0-2%)

Principal Management Problems. Delayed planting of spring grains because the soil is too wet to work is a fairly common problem on this group of soils. This is a serious problem in managing this group of soils because they are actually better adapted for small grains than for corn. Their claypan subsoils make them rather poor corn soils. One solution to the problem of delayed planting of spring grains is use of winter grains which mature early enough to escape high June and July temperatures. Where spring grains are grown they must be handled as efficiently as possible to allow the greatest development during the cooler part of the season. This can be done in most cases by using early

maturing varieties and maintaining a high fertility level in the soils.

Management Group 7, Nearly Level, Imperfectly Drained, Fine-Textured Soils

The soils included are:

No. 31 Cavour, thin surface-Tetonka complex, nearly level (0-2%)
No. 44 Exline complex, level (0-1%)
No. 45 Exline complex, nearly level (2-3%)

Principal Management Problems. The soils in this group are usually wet in the spring and the compact claypans are poorly aerated and therefore restrict root and moisture penetration. Plowing incorporates some of the clay subsoil into the surface soil so that tilth is poor on these soils when they are cultivated. These soils are usually used for native grass pasture and hayland. If used for cropland, rye will do fairly well during favorable years. Corn is not an adapted crop for these soils. Spring sown grains usually are delayed in planting so that often they do not mature before the high temperatures of June and July arrive and thus yields are low.

Management Group 8, Nearly Level, Moderately Shallow Soils

The soils included are:

No. 52 Great Bend-Zell silt loams, nearly level (0-3%)
No. 53 Hamerly loam, nearly level (0-2%)

Principal Management Problems. This group of soils have rather shallow profiles over calcareous parent materials. Because of the shallow profiles, water erosion can be a serious problem on these soils even though they occur on nearly level terrain. The slopes on the Great Bend and Zell soils are smooth while the Hamerly soils have hummocky topography. Where feasible, these soils will probably provide greater long time returns if used for pasture than if used for cropland.

Management Group 9, Gently Undulating Soils with Coarse Substrata

The soils included are:

No. 101 Spottswood loam, nearly level (0-2%)
No. 105 Twin Lakes-Wessington loams, nearly level (0-2%)
No. 106 Twin Lakes-Wessington loams, undulating (3-5%)
No. 107 Wessington loam, nearly level (0-2%)
No. 108 Wessington loam and sandy loam, nearly level (0-2%)
No. 109 Wessington loam and sandy loam, undulating (3-5%)

Principal Management Problems. The coarse substratum of these soils and their generally sandy profiles present problems of low water holding capacity, low fertility, and tendency to drift. Water holding capacity and fertility may be improved some by extra applications of organic matter but limited supplies of organic matter on farms can be used to better advantage on more productive soils. Stubble mulch tillage will aid in controlling drifting. Small grains are better adapted to these soils than corn because these soils dry out in the spring. Small grains can be planted early in the spring and the crop can be ripe before the high July temperatures arrive. The naturally low water-holding capacity of these soils coupled with high July temperatures make corn growing a somewhat hazardous un-

dertaking. Of the included soils, the Spottswood is not as droughty as the others because of the presence of a deep-lying clayey strata which increases the water-holding capacity of the soil.

Management Group 10, Sloping, Well-Drained, Medium-Textured Soils

The soils included are:

No. 21 Beotia silt loam, gently sloping (4-5%)
No. 40 Eckman loam, gently sloping (4-5%)
No. 41 Eckman loam, sloping (6-9%)
No. 46 Great Bend silt loam, gently sloping (4-5%)
No. 49 Great Bend silt loam, sloping (6-9%)
No. 51 Great Bend silt loam, till substratum, gently sloping (4-5%)

Principal Management Problems. The control of water erosion and the maintenance of soil organic matter and soil fertility are the principal problems of management of this group of soils. These soils have smooth slopes and where long enough, and where fields are of adequate size, water erosion can be controlled by contour strip cropping. To aid in erosion control, all tillage should be on the contour. The inclusion of a legume in the rotation one-third of the time will maintain organic matter and a supply of available nitrogen. The Eckman loam soils in this group should be watched for drifting. Where drifting problems arise in this group of soils they can be controlled in years of favorable climatic conditions by stubble mulch tillage.

Management Group 11, Sloping, Medium-Textured, Moderately Shallow Soils

The soils included are:

No. 110 Zell-Great Bend silt loams, gently sloping (4-5%)
No. 111 Zell-Great Bend silt loams, eroded, sloping (6-9%)

Principal Management Problems. The control of runoff and the maintenance of soil organic matter and soil fertility are the principal management problems of this group of soils. Because these soils are quite shallow, water erosion is a serious problem. Where feasible to use these soils for pasture, the returns through grazing will probably result in greater long-time gain than their use for cultivated crops. Keeping these soils in perennial vegetation is the best method of controlling runoff. When used for pasture or hayland, stands can be improved by reseeding with grass-legume mixtures. Mixed stands produce more feed and provide a better balanced grazing season than pure stands of grass.

Management Group 12, Undulating, Well-Drained, Moderately Coarse Textured Soils

The soils included are:

No. 74 Houdek-Bonilla fine sandy loams, undulating (3-5%)
No. 75 Houdek-Groveland fine sandy loams, undulating (3-5%)
No. 76 Houdek fine sandy loam, thin solum, undulating (3-5%)

Principal Management Problems. The control of soil drifting and the maintenance of organic matter and fertility are the principal management problems of this group of soils.

When not in perennial vegetation the soil surface should be protected by a group of crop residues at all times. Organic matter and fertility may be maintained by use of a legume in the rotation.

Management Group 13, Undulating, Well-Drained, Medium-Textured Soils

The soils included are:

No. 67 Houdek-Bonilla loams and silt loams, undulating (3-5%)
No. 68 Houdek-Bonilla loams and silt loams, stony, undulating (3-5%)
No. 69 Houdek-Bonilla silt loams, undulating (3-5%)
No. 70 Houdek-Bonilla silt loams, stony, undulating (3-5%)
No. 71 Houdek loam-Crandon gravelly loam, undulating (3-5%)
No. 72 Houdek silt loam, firm till substratum, undulating (3-5%)
No. 73 Houdek-Cavour loams, and silt loams, gently undulating (2-3%)
No. 77 Houdek loam, thin solum, undulating (3-5%)

Principal Management Problems. The maintenance of soil fertility and organic matter is the principal problem of management of this group of soils. Other problems which require attention are the control of water erosion on the crests of the low hills and knobs which are a part of the undulating terrain of these soils. Stoniness is encountered on all of the soils in this group, but on certain of them it is acute enough to cause the separation of stony phases. Fertility and organic matter can be maintained in this group of soils by inclusion of a legume in the rotation. Water erosion on the crests of the hills can be controlled most satisfactorily by leaving these spots in perennial vegetation. Leaving the soil in a rough condition and using stubble mulch tillage are practices which will reduce runoff.

Management Group 14, Undulating, Well-Drained, Moderately Fine Textured Soils

The soils included are:

No. 10 Beadle silt loam, undulating (3-5%)
No. 11 Beadle silt loam, nonsaline substratum, undulating (3-5%)

Principal Management Problems. The maintenance of organic matter, fertility and tilth, and the control of water erosion and runoff are the principal problems of management of this group of soils. Although there are some stones present, they usually are not concentrated enough to interfere with tillage operations. Organic matter and available nitrogen can be maintained by use of legumes in the rotation. This practice will also aid in maintaining soil tilth. Leaving the soil in a rough condition and using stubble mulch tillage will aid in controlling runoff by increasing the water absorbing ability of the soil.

Management Group 15, Rolling, Well-Drained, Medium-Textured Soils

The soils included are:

No. 78 Houdek loam, rolling (6-9%)
No. 79 Houdek silt loam, rolling (6-9%)
No. 80 Houdek loam, thin solum, rolling (6-9%)
No. 81 Houdek silt loam, firm till substatum, rolling (6-9%)
No. 82 Houdek loam-Crandon gravelly loam, rolling (6-9%)
No. 83 Houdek loam, very stony, rolling (6-9%)

Principal Management Problems. This group of soils needs protection from water erosion. Although some areas of this group of soils are cultivated, the group is poorly suited to cultivation and usually is best used for pasture or hayland. When used for pasture, the principal management problems are those of improving and maintaining good pastures. If the present stand of grasses and legumes is good, management consists of controlled grazing and clipping occasionally to control weeds. Every few years the soils should be disked and reseeded with legumes. If the pasture consists of a fair to poor stand of grass, legumes can be seeded into the sod after disking. After reseeding, a pasture should not be grazed until the legumes have become established in the sod. Controlled grazing should be practiced after that. Additional information on pasture management can be obtained from the county agent or South Dakota State College.

Management Group 16. Hilly Soils

The soils included are:

No. 32 Crandon - Houdek loams, hilly (10-15%)

No. 84 Houdek-Orient loams, hilly (10-30%

No. 85 Houdek-Orient loams, very stony, hilly (10-30%)

No. 99 Orient-Crandon complex, stony, hilly (10-30%)

No. 112 Zell-Great Bend silt loams, eroded, steep (10-30%)

Principal Management Problems. This group includes thin soils on hilly terrain where the rate and amount of runoff is high. If cultivated, these soils would erode severely; moreover the steep slopes make use of machinery difficult. These soils are used best for pasture. The problems of management are those of improving and maintaining pasture. Grass-legume mixtures produce more feed than pure stands of grass. If the present stand of grasses and legumes is good, management consists of controlled grazing. Every few years it may be necessary to disk and reseed with legumes. If the pasture consists of a fair to poor stand of grass, legumes can be seeded into the sod after disking. After reseeding, a pasture should not be grazed until the legumes become established in the sod. Controlled grazing should be practiced after that. Additional information on pasture management can be obtained from the county agent or South Dakota State College.

Management Group 17, Imperfectly Drained Soils of Alluvial Areas and Upland Depressions

The soils included are:

No. 89 La Delle-Lamoure silt loams, nearly level (0-2%)

No. 94 La Prairie-Tetonka silt loams, nearly level (0-2%)

No. 103 Tetonka silt loam

Principal Management Problems. The La Delle-Lamoure and La Prairie soils are alluvial in origin while the Tetonka soils occur in depressions in the upland scattered over the whole county. The imperfectly drained Tetonka soils have been placed in this group, while the wet, poorly drained Tetonka soils are in Management Group 18.

Several problems of management exist for this group of soils. All included soils are usually wet for part of the year during years when climatic conditions are favorable for crop growth on well-drained soils. The La Delle-Lamoure and La Prairie soils occur along streams, so fields of these soils are narrow and of irregular shape. These soils suffer from occasional overflow. Because of wetness and small and irregular field size, the La Delle-Lamore soils are probably best used for hayland. When not too wet these soils are excellent for alfalfa, corn, and small grains. The La Prairie soils occur in long narrow channels in the Lake Bed and are usually farmed with adjacent soils.

The Tetonka soils in this group occur in small shallow depressions and ordinarily an attempt is made to farm them with surrounding, better drained soils. Artificial drainage of these Tetonka soils may be a solution to wetness, but even this practice will not insure that they can be cropped regularly. Costs of drainage should be carefully balanced against anticipated return. When left alone, the wetter areas of the Tetonka soils make excellent wildlife habitats as food, cover, and water are all supplied. Sweet clover or other crops which require large amounts of water can sometimes be used to remove excess moisture from these areas allowing them to be farmed. Reed Canary grass can grow well in wet sites so it may be used in Tetonka depressions to furnish pasture.

Management Group 18, Poorly Drained Soils of Alluvial Areas and Upland Depressions

The soils included are:

No. 92 Lamoure silty clay loam
No. 93 Lamoure silty clay loam, saline
No. 98 Maple silty clay loam
No. 102 Tanberg loamy fine sand
No. 104 Tetonka silt loam, poorly drained

Principal Management Problems. The Lamoure and Maple soils are developed from alluvium and the Tanberg and Tetonka soils occupy poorly drained, upland depressions (potholes). The Lamoure and Maple soils usually receive overflow from adjacent streams and runoff from higher lying land, while the depressions occupied by the Tanberg and Tetonka soils ordinarily collect runoff from associated undulating and rolling upland soils. During years when climatic conditions are unfavorable for crop growth on well-drained soils, these poorly drained soils can be cultivated.

The Lamoure and Maple soils, if protected from overflow and runoff, can be cultivated occasionally. Corn is better adapted to these soils than small grains. High yields can be obtained, especially from the Lamoure soils, if moisture conditions are right, because the soils have a high content of plant nutrients. Yield predictions for corn and small grains are not shown, because they depend on conditions which cannot be held constant.

The poorly drained Tetonka and Tanberg soils which usually occupy large depressions in the upland are cultivated only during a series of dry years. Most of the time they are

wet. When left alone they make excellent habitats for wildlife. Those which are not so wet can be planted to Reed Canary grass and used for pasture. No yields of corn and small grain are predicted for these soils.

Management Group 19, Very Poorly Drained, Alluvial Soils

The soil included is:

No. 100 Rauville silty clay loam, level (0-1%)

Principal Management Problems. This soil is too wet to farm except possibly during a series of very dry years. It occupies the most poorly drained areas on stream bottoms which, along the James River, are the abandoned stream channels of the river. This soil is ordinarily too wet for either cultivation or pasture and its best use is as a wildlife habitat. No yield predictions are made for this soil.

Productivity of the Soils

Yield predictions are presented for each management group except 18 and 19 in Tables 6 to 40. The numbers of the soils included in each group are listed in each table to aid readers in locating the soil type or phase they are interested in. In the description of the individual soil types and phases given earlier in the report, reference is made to the management group the soil falls into for yield predictions. This should also aid in locating a soil in this section of the report.

Before presenting the yield predictions for 17 of the 19 management groups, the general growing conditions for which yields are given will be discussed. Following this the four management systems and the pasture conditions, both of which are used in the yield tables, will be described.

Definitions of Growing Conditions Used in Yield Prediction Tables. The yield predictions given are for three sets of growing conditions: (1) Unfavorable, (2) Favorable, and (3) Very favorable. The factors covered in these growing conditions include climatic conditions; presence of insects, diseases, and weeds; use of adapted crop varieties and good seed; and use of suitable tillage practices.

For both small grain and corn it is assumed that favorable growing conditions are those in which good control of insects, weeds, and diseases is obtained. It is further assumed that adapted crop varieties and good seed are used along with suitable tillage practices.

The favorable growing conditions for small grain include cool, rainy weather with low humidity during spring and early summer. The favorable growing conditions assumed for corn are warm, moist, humid days and nights with adequate summer rainfall and a long growing season.

Management Systems Used in Yield Prediction Tables. Crop yields on any particular soil in Spink County depend on climatic conditions, diseases, insects, fertility, and to a large degree on how the soil is managed. Therefore, in predicting the yields for the soils in Tables 6 to

40, it was necessary to indicate what rotations are being followed and what fertilizers if any, are being used. For all yield predictions it is assumed that satisfactory tillage is practiced, that adapted varieties and good seed are used, and that insect pests, weeds, and diseases are controlled.

In this report the yield predictions are given for four basic cropping systems, designated A, B, C, and D. Systems A and B do not involve legumes, while C and D are rotations using legumes, the former alfalfa, the latter, sweet clover. In System B commercial fertilizers are used to maintain soil fertility.

Cropping System A might be called the average management system. This system consists of continuous small grain, or a sequence of small grain and row crop. This is a soil depleting sequence because the nitrogen and phosphorous removed with the grain are not returned.

In some cases a fallow is used in place of the row crop. Row crops like corn and sorghum, if not weedy are moisture conserving crops. Row crops are usually used rather than fallow in Spink County because they bring some return from the land as well as conserving about half as much moisture as a summer fallow.

Cropping System B is the same as System A except that fertilizer is applied to the soil to make up nutrient losses due to cropping.

Cropping System C is an alfalfa-brome rotation. The basic rotation is as follows:

1. small grain seeded with alfalfa and brome
2. alfalfa-brome 2-6 years
3. small grain
4. row crop
5. small grain

A number of variations of this basic rotation can be used depending upon the needs and desires of the farmer. Small grains and row crops can be interchanged from those proposed. The alfalfa-brome can be handled in several ways. It can be plowed after the first cutting and the soil allowed to lie fallow until the next spring. It can be plowed in the spring and the field planted to corn, or it can be plowed in the fall and planted to either corn or small grain the next spring.

In planning the rotation, the crop following alfalfa should be the highest paying crop so that maximum advantage is taken of the added nitrogen. However, if the soil is dry in the spring, a row crop may be more successful, since it is more likely to respond to late rains than are small grains.

Good stands of alfalfa will return as much as 80 pounds of nitrogen per acre when plowed under during the second or third year but will not add much more nitrogen if left longer. The residual effect of nitrogen from alfalfa plowed under lasts about 3 years or longer.

Alfalfa will dry out the soil so that a partial fallow is usually used after it is turned under unless adequate moisture is present.

Cropping System D is a sweet clover rotation. The basic rotation is as follows:

1. small grain seeded with sweet clover
2. row crop
3. small grain

A number of variations can be used working from this basic rotation. Where sweet clover is plowed in the spring and the land planted, it is important that a row crop be used. The soil will be dry after sweet clover and the row crop will make much better use of June, July, and August rainfall than a small grain crop. In case of failure of moisture the row crop will act as a partial fallow if it is not weedy. If row crops are checked rather than drilled, weeds can be controlled better because the land can be worked from two directions.

The sweet clover can be handled in several ways. It can be allowed to go to seed and be plowed under as soon as the seed crop is taken. It can be cut for hay, plowed under in July and allowed to lie fallow until the next spring. It can be plowed under at blossom and allowed to lie the rest of the year. If moisture conservation is a factor, as it is many times in Spink County, the sweet clover should be plowed under as soon as it is safe to do so in the spring without having it come up again. A good rule of thumb to follow for this plowing is to turn under the sweet clover when the winter buds have all emerged. The soil can lie fallow for the summer and be seeded in the fall or spring.

The small grain crop should follow a fallow if one is used. Small grains depend on available moisture early in the spring while row crops depend almost entirely on rainfall during June, July, and August.

In Tables 6 to 39 the yields of corn and small grain in the sweet clover rotation are lower than they are in the alfalfa rotation. This is because less fertility is available in the sweet clover rotation suggested than in the suggested alfalfa rotation.

On soils subject to wind erosion it is very important to see that the soil is protected at all times.

Definitions of Pasture Conditions Used in Yield Tables. Soils vary in the amount of forage they can produce just as they vary in their ability to produce wheat and corn. The predictions on stocking rates shown in Tables 7 to 40 for each of the 19 groups of soils hinge on the condition of the grassland—whether excellent, good, fair, or poor, and whether it is increasing or decreasing under its present use and management.

The definitions of native pasture conditions are given in Table 5. The classification of plants used is based on the behavior under pasture deterioration from the climax vegetation. That is, there are plant species that will decrease in abundance (decreasers), there are those that will increase in abundance (increasers), there are those that will invade when a pasture is overgrazed (invaders). The definitions for native pasture conditions are as follows: excellent pasture conditions are those in which increasers and decreasers together make up 75 to 100 percent of the stand. Good pasture conditions are those in which increasers and decreasers make up 50 to 75 percent of the stand with invaders making up the balance. For fair pasture conditions increasers and decreasers

Table 5. Pasture Conditions for Native Grass Pastures

Type of Plant	Excellent	Good	Fair	Poor
	%	%	%	%
Increasers and Decreasers	75-100	50-75	25-50	Less 25
Invaders	Less 25	25-50	50-75	More 75

comprise 25 to 50 percent of the stand, while increasers and decreasers make up less than 25 percent of the stand for poor pasture conditions. This classification was proposed in 1940 in Oklahoma and was incorporated in 1948 into a system of range and pasture classification by applying percentages of coverage to them (1).

The stocking rates predicted in Tables 7 to 40 starting on page 112 are in "Animal Unit Months." The number of acres required to supply seasonal pasture for one animal unit may be obtained by dividing the A.U.M. figures given in the tables into the length of the growing season in months. Thus for a pasture having a stocking rate of 2.6 A.U.M., 2.3 acres of pasture would be required to support one cow for a 6-month grazing season. Animal unit equivalents are: one cow (with or without calf) equals 1 unit; one bull equals 1.25 units; one 2-year-old equals 0.8 unit; one yearling equals 0.6 unit; five sheep equal one unit; one horse equals 1.25 units.

Estimated Average Yield Predictions. To make wise decisions in organizing and managing his farm, a farmer needs to know what probable crop yields he can expect from his soils under different systems of management. Those who have been on the same farm many years know how the soils respond to the different systems of management used. There are some systems, however, that they probably have not been able to try. Many who have just begun to farm or have just moved to a new farm with different soils, have little previous experience with the soils they will now farm. To decide what crops to grow and how to manage the soils, farmers must estimate the yields they can expect from the various systems of management that might be practiced under unfavorable, favorable, and very favorable climatic conditions. To assist such farmers, estimates of the average acre yields of the more important crops that can be reasonably expected are given in Tables 6 to 40.

Several important limitations should be kept in mind when using these tables. First, the figures given in the tables are predictions rather than proven facts. They are considered to be reliable enough, however, to be of much value. Second, the predictions are for average yields which might be expected over a period of many years. Third, there is considerable variation in the areas of some soils, mainly because certain combinations had to be made in transferring the soil lines from the large scale field maps to the small scale published map. The field map is of a scale of 4 inches equal 1 mile, while the published map scale is 1 inch equals 1 mile. Fourth, past management of a soil will affect its immediate response to new management practices. Fifth, the devel-

opment of new crop varieties and improved farming methods may affect future yields.

Factors Influencing Yield Predictions. Yields of crops following sweet clover and alfalfa may be seriously reduced in a dry year because the legumes have used most of the available soil moisture. Where nitrogen is obtained from a commercial source rather than from legumes, this competition for moisture does not exist. However, the occasional adverse effects of low available moisture following legumes is minimized by the increased fertility of the soil due to the continued use of legumes. In addition, the use of legumes have other benefits on the soil as is discussed under the section of this report dealing with maintaining organic matter.

In the alfalfa rotation, the yields given are on the basis of a pure stand of alfalfa. The presence of grass with the alfalfa increases the total yield of forage, but will result in lower amounts of nitrogen fixed in the soil.

In comparing the yields of the sweet clover rotation to those where commercial nitrogen was applied, it should be noted that in the latter rotation, 20 pounds of commercial nitrogen were applied to both the corn and to the small grain. In the sweet clover rotation, nitrogen in the form of green manure is added only once in the 2-year rotation.

Yield predictions in the following tables are from a base rate of 20 pounds of commercial nitrogen. In a favorable year, higher rates of commercial nitrogen can be profitably applied. For the present, a lack of nitrogen is the most serious and widespread plant food deficiency problem in Spink County. With favorable moisture and continued high yields of corn and small grain, phosphorus deficiencies may become serious in the future.

The three different types of growing conditions—unfavorable, favorable, and very favorable—were arbitrarily selected to facilitate a condensed presentation of data. The growing conditions of any one year, however, may not fall precisely in any one of the above categories, but may be on the border between two of them. On border years the crop yield will be affected accordingly.

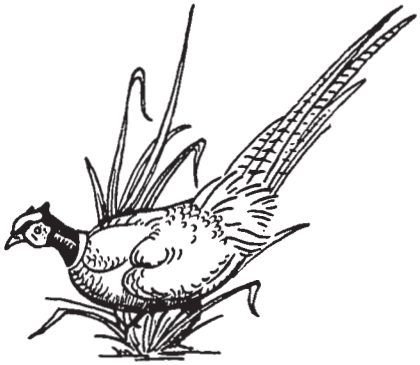


Table 6. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 1

The soils included are: 61, 62, 63, 64, 95, 96, 97.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	8	8	8	5
Wheat, Bu.	3	6	6	5
Oats, Bu.	7	10	10	9
Barley, Bu.	5	8	8	7
Alfalfa, T.	----	--------	0.65	----
Wild Hay, T.	----	0.43	--------	----
Favorable Growing Conditions§				
Corn, Bu.	24	31	33	29
Wheat, Bu.	9	14	16	12
Oats, Bu.	20	27	30	25
Barley, Bu.	14	20	22	18
Alfalfa, T.	----	--------	1.60	----
Wild Hay, T.	----	0.82	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	33	41	45	38
Wheat, Bu.	14	22	25	19
Oats, Bu.	34	47	50	40
Barley, Bu.	23	33	36	28
Alfalfa, T.	----	--------	1.95	----
Wild Hay, T.	----	1.12	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 7. Stocking Rates for Pasture for Soils of Management Group 1

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.1	1.8	1.4	0.8
Tame grass	1.3	1.1	0.8	0.5
Native grass	0.8	0.7	0.5	0.35

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 8. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 2

The soils included are: 26, 27, 28, 43, 59, 60.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	7	8	8	6
Wheat, Bu.	3	6	6	5
Oats, Bu.	9	12	12	11
Barley, Bu.	6	8	8	7
Alfalfa, T.	----	--------	0.85	----
Wild Hay, T.	----	0.55	--------	----
Favorable Growing Conditions§				
Corn, Bu.	25	32	34	30
Wheat, Bu.	11	16	18	15
Oats, Bu.	25	32	35	31
Barley, Bu.	15	21	23	19
Alfalfa, T.	----	--------	1.65	----
Wild Hay, T.	----	0.75	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	34	42	46	39
Wheat, Bu.	14	22	25	18
Oats, Bu.	37	50	53	43
Barley, Bu.	24	33	36	29
Alfalfa, T.	----	--------	2.10	----
Wild Hay, T.	----	0.95	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 9. Stocking Rates for Pasture for Soils of Management Group 2

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.3	1.9	1.5	0.9
Tame grass	1.5	1.3	1.0	0.6
Native grass	0.9	0.8	0.6	0.4

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 10. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 3

The soils included are: 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 34, 35, 36, 37, 38, 39, 42, 47, 48, 50, 54, 86, 87.

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	5	6	5	4
Wheat, Bu.	4	8	8	6
Oats, Bu.	10	16	16	12
Barley, Bu.	7	12	12	9
Alfalfa, T.	----	--------	1.10	----
Wild Hay, T.	----	0.35	--------	----
Favorable Growing Conditions§				
Corn, Bu.	18	22	24	20
Wheat, Bu.	13	19	20	17
Oats, Bu.	28	36	38	32
Barley, Bu.	17	24	26	23
Alfalfa, T.	----	--------	1.85	----
Wild Hay, T.	----	0.90	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	27	35	42	32
Wheat, Bu.	19	28	30	23
Oats, Bu.	45	56	60	52
Barley, Bu.	29	37	42	35
Alfalfa, T.	----	--------	2.16	----
Wild Hay, T.	----	1.24	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 11. Stocking Rates for Pasture for Soils of Management Group 3

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.6	2.2	1.7	1.1
Tame grass	1.7	1.4	1.1	0.7
Native grass	1.1	0.9	0.7	0.5

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 12. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 4

The soils included are: 6, 7, 8, 9, 13, 14, 33, 55, 56, 57, 58, 88, 90, 91

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	5	6	5	4
Wheat, Bu.	4	8	8	6
Oats, Bu.	10	16	16	12
Barley, Bu.	7	13	12	9
Alfalfa, T.	----	--------	0.95	----
Wild Hay, T.	----	0.30	--------	----
Favorable Growing Conditions§				
Corn, Bu.	16	22	24	21
Wheat, Bu.	12	18	19	15
Oats, Bu.	28	36	38	32
Barley, Bu.	16	23	25	22
Alfalfa, T.	----	--------	1.80	----
Wild Hay, T.	----	0.85	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	25	33	40	31
Wheat, Bu.	20	28	30	24
Oats, Bu.	44	56	60	52
Barley, Bu.	29	37	44	35
Alfalfa, T.	----	--------	2.10	----
Wild Hay, T.	----	1.20	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 13. Stocking Rates for Pasture for Soils of Management Group 4

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.5	2.1	1.6	1.0
Tame grass	1.6	1.4	1.0	0.6
Native grass	1.0	0.8	0.7	0.4

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 14. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 5

The soils included are: 65, 66.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	5	5	5	5
Wheat, Bu.	3	6	6	5
Oats, Bu.	7	10	12	10
Barley, Bu.	4	6	7	6
Alfalfa, T.	----	--------	0.5	----
Wild Hay, T.	----	0.3	--------	----
Favorable Growing Conditions§				
Corn, Bu.	11	18	21	19
Wheat, Bu.	7	11	14	10
Oats, Bu.	19	26	30	25
Barley, Bu.	10	16	18	15
Alfalfa, T.	----	--------	1.15	----
Wild Hay, T.	----	0.5	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	21	29	36	30
Wheat, Bu.	12	18	21	16
Oats, Bu.	30	40	43	36
Barley, Bu.	22	29	32	27
Alfalfa, T.	----	--------	1.45	----
Wild Hay, T.	----	0.7	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 15. Stocking Rates for Pasture for Soils of Management Group 5

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	1.6	1.4	1.0	0.6
Tame grass	1.0	0.8	0.7	0.45
Native grass	0.6	0.5	0.45	0.4

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 16. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 6

The soils included are: 1, 2, 3, 4, 5, 12, 29, 30.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	3	4	5	4
Wheat, Bu.	3	6	7	5
Oats, Bu.	8	11	12	10
Barley, Bu.	5	8	9	7
Alfalfa, T.	----	--------	0.5	----
Wild Hay, T.	----	0.4	--------	----
Favorable Growing Conditions§				
Corn, Bu.	11	16	18	15
Wheat, Bu.	10	15	17	14
Oats, Bu.	22	28	30	27
Barley, Bu.	15	20	22	19
Alfalfa, T.	----	--------	1.3	----
Wild Hay, T.	----	0.6	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	19	25	30	23
Wheat, Bu.	17	24	27	21
Oats, Bu.	37	47	51	43
Barley, Bu.	25	32	36	30
Alfalfa, T.	----	--------	1.5	----
Wild Hay, T.	----	0.7	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 17. Stocking Rates for Pasture for Soils of Management Group 6

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	1.8	1.5	1.2	0.8
Tame grass	1.1	0.9	0.7	0.5
Native grass	0.7	0.6	0.5	0.45

*The number of months one acre will support one aniaml unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 18. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 7

The soils included are: 31, 44, 45.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	3	3	3	3
Wheat, Bu.	3	5	5	5
Oats, Bu.	7	10	10	10
Barley, Bu.	5	6	6	6
Alfalfa, T.	----	----	0.4	----
Wild Hay, T.	----	0.25	----	----
Favorable Growing Conditions§				
Corn, Bu.	8	11	13	12
Wheat, Bu.	5	9	12	11
Oats, Bu.	12	16	18	17
Barley, Bu.	8	11	13	12
Alfalfa, T.	----	----	1.0	----
Wild Hay, T.	----	0.50	----	----
Very Favorable Growing Conditions§				
Corn, Bu.	12	16	18	17
Wheat, Bu.	10	14	17	15
Oats, Bu.	19	23	26	24
Barley, Bu.	15	19	22	20
Alfalfa, T.	----	----	1.2	----
Wild Hay, T.	----	0.75	----	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 19. Stocking Rates for Pasture for Soils of Management Group 7

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	1.4	1.2	0.9	0.6
Tame grass	0.9	0.8	0.6	0.45
Native grass	0.6	0.5	0.45	4.0

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 20. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 8

The soils included are: 52, 53.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	4	6	5	4
Wheat, Bu.	3	7	7	6
Oats, Bu.	6	12	12	10
Barley, Bu.	4	8	8	7
Alfalfa, T.	----	----	0.95	----
Wild Hay, T.	----	0.30	----	----
Favorable Growing Conditions§				
Corn, Bu.	11	17	20	16
Wheat, Bu.	8	16	18	15
Oats, Bu.	18	28	30	27
Barley, Bu.	12	19	22	18
Alfalfa, T.	----	----	1.65	----
Wild Hay, T.	----	0.80	----	----
Very Favorable Growing Conditions§				
Corn, Bu.	21	29	33	28
Wheat, Bu.	13	21	24	21
Oats, Bu.	31	41	45	40
Barley, Bu.	21	31	35	30
Alfalfa, T.	----	----	1.9	----
Wild Hay, T.	----	1.10	----	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 21. Stocking Rates for Pasture for Soils of Management Group 8

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.3	2.0	1.5	0.9
Tame grass	1.5	1.3	1.0	0.6
Native grass	1.0	0.8	0.7	0.45

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 22. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 9

The soils included are: 101, 105, 106, 107, 108, 109.

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	5	6	6	5
Wheat, Bu.	3	6	6	5
Oats, Bu.	6	8	8	6
Barley, Bu.	4	6	6	5
Alfalfa, T.	----	--------	0.7	----
Wild Hay, T.	----	0.25	--------	----
Favorable Growing Conditions§				
Corn, Bu.	13	19	21	18
Wheat, Bu.	8	13	15	12
Oats, Bu.	18	26	28	24
Barley, Bu.	12	19	21	16
Alfalfa, T.	----	--------	1.45	----
Wild Hay, T.	----	0.70	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	31	38	40	36
Wheat, Bu.	12	20	23	18
Oats, Bu.	30	40	42	38
Barley, Bu.	20	28	30	26
Alfalfa, T.	----	--------	1.85	----
Wild Hay, T.	----	1.00	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 23. Stocking Rates for Pasture for Soils of Management Group 9

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.3	2.0	1.5	0.9
Tame grass	1.5	1.3	1.0	0.6
Native grass	0.9	0.8	0.6	0.45

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 24. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 10

The soils included are: 21, 40, 41, 46, 49, 51

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	4	6	5	4
Wheat, Bu.	3	5	5	5
Oats, Bu.	7	10	12	11
Barley, Bu.	5	7	8	7
Alfalfa, T.	----	--------	0.9	----
Wild Hay, T.	----	0.25	--------	----
Favorable Growing Conditions§				
Corn, Bu.	11	15	18	15
Wheat, Bu.	9	14	16	14
Oats, Bu.	20	26	30	26
Barley, Bu.	11	16	19	16
Alfalfa, T.	----	--------	1.5	----
Wild Hay, T.	----	0.75	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	23	31	34	31
Wheat, Bu.	15	21	23	21
Oats, Bu.	33	42	45	42
Barley, Bu.	21	30	33	30
Alfalfa, T.	----	--------	1.85	----
Wild Hay, T.	----	1.10	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 25. Stocking Rates for Pasture for Soils of Management Group 10

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.2	1.9	1.4	0.9
Tame grass	1.4	1.2	0.9	0.6
Native grass	0.9	0.8	0.6	0.4

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 26. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 11

The soils included are: 110, 111.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	2	4	4	3
Wheat, Bu.	2	5	5	5
Oats, Bu.	4	6	6	6
Barley, Bu.	3	4	4	4
Alfalfa, T.	----	----	0.65	----
Wild Hay, T.	----	0.20	----	----
Favorable Growing Conditions§				
Corn, Bu.	8	12	14	12
Wheat, Bu.	5	10	12	11
Oats, Bu.	12	20	22	20
Barley, Bu.	8	13	15	12
Alfalfa, T.	----	----	1.30	----
Wild Hay, T.	----	0.52	----	----
Very Favorable Growing Conditions§				
Corn, Bu.	14	20	22	20
Wheat, Bu.	8	14	16	15
Oats, Bu.	20	27	32	28
Barley, Bu.	13	18	20	19
Alfalfa, T.	----	----	1.5	----
Wild Hay, T.	----	0.90	----	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 28. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 12

The soils included are: 74, 75, 76.

Crop	Systems of Soil Management* A: Corn, Small Grain	B: Corn, Small Grain, 20 Lb. Nitrogen on Both	C: Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	D: Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	6	7	7	6
Wheat, Bu.	3	6	6	5
Oats, Bu.	7	10	10	9
Barley, Bu.	5	7	7	6
Alfalfa, T.	----	----	0.8	----
Wild Hay, T.	----	0.30	----	----
Favorable Growing Conditions§				
Corn, Bu.	14	21	24	20
Wheat, Bu.	9	15	17	14
Oats, Bu.	20	26	29	25
Barley, Bu.	14	19	21	18
Alfalfa, T.	----	----	1.55	----
Wild Hay, T.	----	0.75	----	----
Very Favorable Growing Conditions§				
Corn, Bu.	25	32	34	30
Wheat, Bu.	14	21	23	19
Oats, Bu.	34	43	46	42
Barley, Bu.	23	31	33	30
Alfalfa, T.	----	----	1.85	----
Wild Hay, T.	----	1.10	----	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 27. Stocking Rates for Pasture for Soils of Management Group 11

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	1.8	1.5	1.2	0.8
Tame grass	1.1	0.9	0.7	0.5
Native grass	0.6	0.5	0.45	0.4

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 29. Stocking Rates for Pasture for Soils of Management Group 12

Kind of Pasture	Pasture Conditions: Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.0	1.7	1.3	0.8
Tame grass	1.3	1.1	0.8	0.5
Native grass	0.9	0.8	0.6	0.4

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 30. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 13

The soils included are: 67, 68, 69, 70, 71, 72, 73, 77.

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	4	7	7	4
Wheat, Bu.	3	6	6	5
Oats, Bu.	8	10	10	9
Barley, Bu.	5	7	7	6
Alfalfa, T.	----	--------	0.88	----
Wild Hay, T.	----	0.35	--------	----
Favorable Growing Conditions§				
Corn, Bu.	15	23	26	22
Wheat, Bu.	11	16	18	15
Oats, Bu.	22	28	31	27
Barley, Bu.	14	20	23	19
Alfalfa, T.	----	--------	1.50	----
Wild Hay, T.	----	0.80	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	26	33	35	32
Wheat, Bu.	15	21	23	19
Oats, Bu.	37	46	49	44
Barley, Bu.	25	32	34	31
Alfalfa, T.	----	----	1.90	----
Wild Hay, T.	----	1.15	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 31. Stocking Rates for Pasture for Soils of Management Group 13

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.2	1.9	1.4	0.9
Tame grass	1.5	1.3	1.0	0.6
Native grass	1.0	0.8	0.7	0.45

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 32. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 14

The soils included are: 10, 11.

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	4	5	4	4
Wheat, Bu.	3	7	7	6
Oats, Bu.	8	12	12	11
Barley, Bu.	5	11	11	10
Alfalfa, T.	----	--------	0.80	----
Wild Hay, T.	----	0.30	--------	----
Favorable Growing Conditions§				
Corn, Bu.	14	20	22	19
Wheat, Bu.	10	16	17	14
Oats, Bu.	22	30	32	28
Barley, Bu.	14	21	23	20
Alfalfa, T.	----	--------	1.65	----
Wild Hay, T.	----	0.75	--------	----
Very Favorable Growing Conditions§				
Corn, Bu.	23	31	35	29
Wheat, Bu.	16	24	26	22
Oats, Bu.	37	47	50	45
Barley, Bu.	25	31	36	30
Alfalfa, T.	----	--------	1.95	----
Wild Hay, T.	----	1.10	--------	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 33. Stocking Rates for Pasture for Soils of Management Group 14

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.3	2.0	1.5	0.9
Tame grass	1.5	1.3	1.0	0.6
Native grass	0.9	0.8	0.6	0.45

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 34. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 15

The soils included are: 78, 79, 80, 81, 82, 83.

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	3	5	5	3
Wheat, Bu.	2	4	3	3
Oats, Bu.	4	6	5	5
Barley, Bu.	3	5	4	4
Alfalfa, T.	----	----	0.75	----
Wild Hay, T.	----	0.30	----	----
Favorable Growing Conditions§				
Corn, Bu.	8	13	15	12
Wheat, Bu.	5	10	12	9
Oats, Bu.	12	19	21	18
Barley, Bu.	8	14	15	13
Alfalfa, T.	----	----	1.35	----
Wild Hay, T.	----	0.70	----	----
Very Favorable Growing Conditions§				
Corn, Bu.	14	19	23	18
Wheat, Bu.	8	15	18	14
Oats, Bu.	20	28	32	27
Barley, Bu.	13	18	22	17
Alfalfa, T.	----	----	1.80	----
Wild Hay, T.	----	1.05	----	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 35. Stocking Rates for Pasture for Soils of Management Group 15

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	1.9	1.6	1.2	0.8
Tame grass	1.2	1.0	0.8	0.5
Native grass	0.8	0.7	0.5	0.35

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 36. Stocking Rates for Pasture for Soils of Management Group 16

The soils included are: 32, 84, 85, 99, 112.

	Pasture Conditions			
Kind of Pasture	Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	1.2	1.0	0.8	0.5
Tame grass	0.8	0.7	0.5	0.35
Native grass	0.5	0.4	0.35	0.3

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 37. Estimated Yields Per Acre of Crops Under Three Growing Conditions and Four Systems of Management for Soils of Management Group 17

The soils included are: 89, 94, 103.

	Systems of Soil Management*			
	A	B	C	D
Crop	Corn, Small Grain	Corn, Small Grain, 20 Lb. Nitrogen on Both	Small Grain, Alfalfa (2-6 Yrs.)† Small Grain, Corn, Small Grain	Small Grain Plus Sweet Clover‡, Corn, Small Grain
Unfavorable Growing Conditions§				
Corn, Bu.	6	7	8	7
Wheat, Bu.	4	8	8	7
Oats, Bu.	11	16	16	12
Barley, Bu.	7	11	12	10
Alfalfa, T.	----	----	1.30	----
Wild Hay, T.	----	0.50	----	----
Favorable Growing Conditions§				
Corn, Bu.	18	23	26	22
Wheat, Bu.	14	19	21	17
Oats, Bu.	30	36	39	36
Barley, Bu.	19	24	27	23
Alfalfa, T.	----	----	2.0	----
Wild Hay, T.	----	1.00	----	----
Very Favorable Growing Conditions§				
Corn, Bu.	31	35	42	33
Wheat, Bu.	20	28	31	26
Oats, Bu.	45	56	60	53
Barley, Bu.	30	37	42	35
Alfalfa, T.	----	----	2.25	----
Wild Hay, T.	----	1.30	----	----

*See page 107 for discussion of these four systems of management.
†Second cutting of alfalfa is plowed under.
‡Sweet clover is plowed under when 6 to 8 inches high.
§See page 107 for description of growing conditions.

Table 38. Stocking Rates for Pasture for Soils of Management Group 17

Kind of Pasture	Pasture Conditions Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	2.8	2.4	1.8	1.1
Tame grass	1.8	1.5	1.2	0.8
Native grass	1.2	1.0	0.8	0.5

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Table 39. Estimated Wild Hay Yields under Three Growing Conditions for Soils of Management Group 18
The soils included are: 92, 93, 98, 102, 104.

Growing Conditions*	Yield of Wild Hay, T.
Unfavorable	0.55
Favorable	1.10
Very Favorable	1.40

*See page 107 for description of growing conditions.

Table 40. Stocking Rates for Pasture for Soils of Management Group 18

Kind of Pasture	Pasture Conditions Excellent	Good	Fair	Poor
	Animal Unit Months*			
Legume-grass	----	----	----	----
Tame grass	1.9	1.6	1.2	0.8
Native grass	1.3	1.1	0.8	0.5

*The number of months one acre will support one animal unit during the grazing season. The number of acres required to supply seasonal pasture may be obtained by dividing the A.U.M. figures into the number 6. This is based on a 6-month grazing season. See page 110 for animal unit equivalents.

Productivity Ratings

The soils of the 19 management groups are rated in Table 41 according to their relative productivity for the principal crops grown in the county. This table is used to supplement Table 6 to 40 by showing how the yields given for Spink County compare with those on soils considered the most productive for the crop in the United States as a whole. The indexes given correspond to yields given for Management System A (average) under favorable growing conditions, except the alfalfa index which is for Management System C under favorable growing conditions.

The rating expresses the productivity of each group of soils for each crop as a percentage of the standard. The standard yield is given an index number of 100. It represents the average yield in a farming system, without the use of fertilizers and other mineral amendments, of the most productive group of soils of important extent in the United States where the crop is generally grown. An index of 50 indicates that a soil is about one-half as productive for the specified crop as the soil with the standard index. (The limitations discussed on page 110 which apply to Tables 6 to 40 apply to the use of Table 41.)

Productivity indexes cannot be interpreted into land values except in a general way. Distance to market, relative prices of farm products, and other factors influence the value of land.

Potential Irrigability of the Soils

Land classification for irrigation, although based in large part on the physical, chemical, and slope characteristics of soils, is really an economic classification. This is because each class of land must be rated not only in terms of production under irrigation, but also in terms of its probable use and the income which will be available to meet land development costs. "Arable" land as used in Federal irrigation projects is de-

Table 41. Productivity Ratings of the Soil Management Groups

Management Group	Description of Management Group*	Crop Productivity Index: Spring Wheat† 100= 25 Bu.	Corn† 100= 50 Bu.	Oats† 100= 50 Bu.	Barley† 100= 40 Bu.	Alfalfa‡ 100= 4 Tons
1	Nearly level to undulating, well-drained, coarse-textured soils	36	48	40	35	40
2	Nearly level, well-drained, moderately coarse-textured soils	44	50	50	38	41
3	Nearly level, well-drained, medium-textured soils	52	36	56	43	46
4	Nearly level, well-drained, moderately fine-textured soils	48	32	56	40	45
5	Nearly level, imperfectly drained sandy soils with claypans	28	22	38	25	29
6	Nearly level, imperfectly drained, moderately fine-textured soils with claypans	40	22	44	38	33
7	Nearly level, imperfectly drained, fine-textured soils	20	16	24	20	25
8	Nearly level, moderately shallow soils	32	22	36	30	41
9	Gently undulating soils with coarse substrata	32	26	36	30	36
10	Sloping, well-drained, medium-textured soils	36	22	40	28	38
11	Sloping, medium-textured, moderately shallow soils	20	16	24	20	33
12	Undulating, well-drained, moderately coarse-textured soils	36	28	40	35	39
13	Undulating, well-drained, medium-textured soils	44	30	44	35	38
14	Undulating, well-drained, moderately fine-textured soils	40	28	44	35	41
15	Rolling, well-drained, medium-textured soils	20	16	24	20	34
16	Hilly soils	§	----	----	----	----
17	Imperfectly drained soils of alluvial areas and upland depressions	56	36	60	48	50
18	Poorly drained soils of alluvial areas and upland depressions	----	----	----	----	----
19	Very poorly drained, alluvial soils	----	----	----	----	----

*See text starting on page 99 for included soils.

†These indexes correspond to yields given in Tables 6 to 39 for Management Group A (average) under favorable growing conditions.

‡These indexes correspond to yields given in Tables 6 to 39 for Management Group C under favorable growing conditions.

§Dash indicates that crops are not adapted or are dependent upon local conditions of flooding or overflow which cannot be predicted.

fined as land which in adequate units and when properly provided with improvements of leveling, drainage, buildings, irrigation facilities, and the like, will have productive capacity under sustained irrigation sufficient to meet all production expenses and provide a satisfactory level of living for the farm family. Arable lands are not classi-

fied as "irrigable" until they are included in a final project plan.

The soils of Spink County are classified in Table 42 as to "potential irrigability." No economic analysis has been made to determine the income which will be available to meet land development costs. Moreover, no attempt has been made to determine if good land occurs in sufficiently large blocks to support irrigation costs.

The classification is based entirely on the physical, chemical, and slope characteristics of the soils. The soil types and phases are placed into one of the five groups—excellent, good, fair, poor, and unsatisfactory—based on the number of limiting factors each soil has and the intensity of the limitation. The limiting factors used in this classification are: unfavorable texture (either too coarse or too fine), shallow depth to incoherent sand and gravel, presence of a restricting claypan in the soil, shallow depth to the layer of lime accumulation, shallow depth to alkali or salt layers, and unfavorable topography.

The classification of soils into potential irrigability classes must consider further whether gravity or sprinkler type of irrigation is to be used. With the development of new techniques for sprinkler irrigation such as gated pipe, much land with topography unfavorable for gravity irrigation can be successfully irrigated using sprinklers. The future development of new methods of handling water and soils under irrigation may alter the ratings shown in Table 42.

Table 42. Potential Irrigability of the Soils of Spink County

Map Number	Soil Types and Phases	Potential Suitability for Sprinkler Irrigation	Potential Suitability for Gravity Irrigation
1.	Aberdeen silty clay loam, level (0-1%)	poor	poor
2.	Aberdeen silty clay loam, nearly level (2-3%)	poor	poor
3.	Aberdeen silty clay loam, till substratum, level (0-1%)	poor	poor
4.	Aberdeen loam, level (0-1%)	poor	poor
5.	Aberdeen-Harmony silty clay loams, level (0-1%)	poor	poor
6.	Beadle silt loam, nearly level (0-2%)	fair	fair
7.	Beadle silt loam, stony, nearly level (0-2%)	poor	poor
8.	Beadle silt loam, nonsaline substratum, nearly level (0-2%)	fair	fair
9.	Beadle silt loam, stony, nonsaline substratum, nearly level (0-2%)	poor	poor
10.	Beadle silt loam, undulating (3-5%)	poor	poor
11.	Beadle silt loam, nonsaline substratum, undulating (3-5%)	poor	poor
12.	Beadle-Cavour silt loams, nearly level (0-2%)	poor	poor
13.	Beadle-Cresbard silt loams, nearly level (0-2%)	poor	poor
14.	Beadle-Houdek-Cresbard silt loams, nearly level (0-2%)	poor	poor
15.	Beotia silt loam, level (0-1%)	excellent	excellent
16.	Beotia silt loam, moderately saline substratum, level (0-1%)	good	good
17.	Beotia silt loam, till substratum, level (0-1%)	good	fair
18.	Beotia silt loam, nearly level (2-3%)	excellent	excellent

Table 42. Potential Irrigability of the Soils of Spink County (Continued)

Map Number	Soil Types and Phases	Potential Suitability for Sprinkler Irrigation	Potential Suitability for Gravity Irrigation
19.	Beotia silt loam, moderately saline substratum, nearly level (2-3%)	good	good
20.	Beotia silt loam, till substratum, nearly level (2-3%)	good	fair
21.	Beotia silt loam, gently sloping (4-5%)	good	fair
22.	Beotia silt loam, valley phase, nearly level (0-2%)	good	good
23.	Bonilla-Houdek loams, nearly level (0-2%)	fair	fair
24.	Bonilla-Houdek silt loams, nearly level (0-2%)	fair	fair
25.	Bonilla-Cresbard silt loams, nearly level (0-2%)	fair	fair
26.	Bonilla-Houdek fine sandy loams, nearly level (0-2%)	good	good
27.	Bonilla-Houdek fine sandy loams, firm till substratum, nearly level (0-2%)	fair	poor
28.	Bonilla-Groveland fine sandy loams, nearly level (0-2%)	good	good
29.	Cavour-Beadle silt loams, nearly level (0-2%)	poor	poor
30.	Cavour-Houdek loams, nearly level (0-2%)	poor	poor
31.	Cavour, thin surface-Tetonka complex, nearly level (0-2%)	unsuitable	unsuitable
32.	Crandon-Houdek loams, hilly (10-15%)	unsuitable	unsuitable
33.	Cresbard-Beadle silt loams, nearly level (0-2%)	poor	poor
34.	Cresbard-Bonilla silt loams, nearly level (0-2%)	poor	poor
35.	Doland silt loam, nearly level (0-2%)	excellent	good
36.	Doland silt loam, loamy fine sandy substratum, gently sloping (3-5%)	excellent	good
37.	Doland silt loam-Solentz complex, nearly level (0-2%)	fair	fair
38.	Eckman loam, nearly level (2-3%)	excellent	excellent
39.	Eckman loam, level (0-1%)	excellent	excellent
40.	Eckman loam, gently sloping (4-5%)	excellent	good
41.	Eckman loam, sloping (6-9%)	fair	unsuitable
42.	Eckman loam, valley phase, nearly level (0-2%)	excellent	good
43.	Eckman fine sandy loam, nearly level (0-2%)	excellent	excellent
44.	Exline complex, level (0-1%)	unsuitable	unsuitable
45.	Exline complex, nearly level (2-3%)	unsuitable	unsuitable
46.	Great Bend silt loam, gently sloping (4-5%)	good	fair
47.	Great Bend silt loam, nearly level (2-3%)	excellent	good
48.	Great Bend silt loam, level (0-1%)	excellent	excellent
49.	Great Bend silt loam, sloping (6-9%)	fair	unsuitable
50.	Great Bend silt loam, till substratum, nearly level (2-3%)	good	fair
51.	Great Bend silt loam, till substratum, gently sloping (4-5%)	good	poor
52.	Great Bend-Zell silt loams, nearly level (0-3%)	fair	poor
53.	Hamerly loam, nearly level (0-2%)	poor	poor
54.	Hand-Houdek loams, gently undulating (1-3%)	good	fair
55.	Harmony silty clay loam, level (0-1%)	fair	fair
56.	Harmony silty clay loam, nearly level (2-3%)	fair	fair
57.	Harmony silty clay loam, till substratum, level (0-1%)	fair	poor
58.	Harmony loam, level (0-1%)	fair	fair
59.	Hecla sandy loam, nearly level (0-2%)	good	fair
60.	Hecla sandy loam, till substratum, nearly level (0-2%)	good	poor
61.	Hecla loamy fine sand, nearly level (0-2%)	good	fair
62.	Hecla loamy fine sand, till substratum, nearly level (0-2%)	good	poor
63.	Hecla-Hamar loamy fine sands, nearly level (0-2%)	fair	fair
64.	Hecla-Hamar loamy fine sand, wind eroded, hummocky (0-2%)	fair	poor
65.	Hecla-Letcher loamy fine sands, nearly level (0-2%)	fair	poor
66.	Hecla-Letcher sandy loams, nearly level (0-2%)	fair	poor

Table 42. Potential Irrigability of the Soils of Spink County (Continued)

Map Number	Soil Types and Phases	Potential Suitability for Sprinkler Irrigation	Potential Suitability for Gravity Irrigation
67.	Houdek-Bonilla loams and silt loams, undulating (3-5%)	fair	poor
68.	Houdek-Bonilla loams and silt loams, stony, undulating (3-5%)	fair	poor
69.	Houdek-Bonilla silt loams, undulating (3-5%)	fair	poor
70.	Houdek-Bonilla silt loams, stony, undulating (3-5%)	fair	poor
71.	Houdek loam-Crandon gravelly loam, undulating (3-5%)	poor	unsuitable
72.	Houdek silt loam, firm till substratum, undulating (3-5%)	good	poor
73.	Houdek-Cavour loams and silt loams, gently undulating (2-3%)	fair	unsuitable
74.	Houdek-Bonilla fine sandy loams, undulating (3-5%)	good	fair
75.	Houdek-Groveland fine sandy loams, undulating (3-5%)	good	fair
76.	Houdek fine sandy loam, thin solum, undulating (3-7%)	fair	poor
77.	Houdek loam, thin solum, undulating (3-5%)	fair	poor
78.	Houdek loam, rolling (6-9%)	poor	unsuitable
79.	Houdek silt loam, rolling (6-9%)	poor	unsuitable
80.	Houdek loam, thin solum, rolling (6-9%)	unsuitable	unsuitable
81.	Houdek silt loam, firm till substratum, rolling (6-9%)	poor	unsuitable
82.	Houdek loam-Crandon gravelly loam, rolling (6-9%)	unsuitable	unsuitable
83.	Houdek loam, very stony, rolling (6-9%)	unsuitable	unsuitable
84.	Houdek-Orient loams, hilly (10-30%)	unsuitable	unsuitable
85.	Houdek-Orient loams, very stony, hilly (10-30%)	unsuitable	unsuitable
86.	La Delle silt loam, level (0-1%)	excellent	fair
87.	La Delle silt loam, nearly level (2-3%)	excellent	fair
88.	La Delle silty clay loam, level (0-1%)	fair	poor
89.	La Delle-Lamoure silt loams, nearly level (0-2%)	good	unsuitable
90.	La Delle-Northville silty clay loams, level (0-1%)	poor	unsuitable
91.	La Delle-Northville silt loams, level (0-1%)	fair	unsuitable
92.	Lamoure silty clay loam	poor	unsuitable
93.	Lamoure silty clay loam, saline	unsuitable	unsuitable
94.	La Prairie-Tetonka silt loams, nearly level (0-2%)	unsuitable	unsuitable
95.	Maddock sandy loam, undulating (3-5%)	fair	poor
96.	Maddock loamy fine sand, till substratum, undulating (3-5%)	fair	unsuitable
97.	Maddock-Hamar loamy fine sand, wind eroded, hummocky (3-5%)	fair	poor
98.	Maple silty clay loam	unsuitable	unsuitable
99.	Orient-Crandon complex, stony, hilly (10-30%)	unsuitable	unsuitable
100.	Rauville silty clay loam	unsuitable	unsuitable
101.	Spottswood loam, nearly level (0-2%)	good	fair
102.	Tanberg loamy fine sand	unsuitable	unsuitable
103.	Tetonka silt loam	unsuitable	unsuitable
104.	Tetonka silt loam, poorly drained	unsuitable	unsuitable
105.	Twin Lakes-Wessington loams, nearly level (0-2%)	fair	poor
106.	Twin Lakes-Wessington loams, undulating (3-5%)	poor	unsuitable
107.	Wessington loam, nearly level (0-2%)	good	good
108.	Wessington loam and sandy loam, nearly level (0-2%)	good	good
109.	Wessington loam and sandy loam, undulating (3-5%)	good	fair
110.	Zell-Great Bend silt loams, gently sloping (4-5%)	poor	unsuitable
111.	Zell-Great Bend silt loams, eroded, sloping (6-9%)	unsuitable	unsuitable
112.	Zell-Great Bend silt loams, eroded, steep (10-30%)	unsuitable	unsuitable

AGRICULTURE OF SPINK COUNTY

SOME OF THE CHARACTERISTICS of Spink County agriculture are described in this section, principally for readers not familiar with the county. Subjects covered include crops, permanent pastures, livestock, major sources of income, size of farms, farm tenancy, types of farms, and farm values and expenditures.

In 1880 before the railroad came to Spink County the few settlers in the county raised staple crops of corn and wheat for food and flax for fiber. Sheep and cattle were kept for fiber and meat. The railroad came through in the early 1880's. By 1890 over 10,000 people were county residents and a commercial agriculture with wheat as the main crop had replaced the subsistence agriculture of the first settlers. (3)

The 1950 Federal Census shows that the 1,641 farms occupied 94.6 percent of the county, or 914,819 acres, and had an average size of 557.5 acres. In 1890 about 60 percent of the land in the county was in farms and every census from 1890 to 1930 showed an increase of land in farms. The record high farm acreage of 917,151 acres was reached in 1930. This figure dropped off about 45,000 acres between 1930 and 1935 and has been increasing slowly since then.

The uses made of the land in farms in 1945 as reported by the Federal Census were as follows: cropland 75.9 percent, pasture 18.7 percent, and other land 5.4 percent.

Crops

More land is devoted to hard red spring wheat than any other crop in the county. In 1944, according to the South Dakota Crop Reporting Service, 45.3 percent of the harvested cropland was in this crop. In 12 townships in 1945 over half of the cropland was in spring wheat. In 1950 Spink County ranked first among the counties of the state in the production of hard red spring wheat, producing 2,606,000 bushels.

An important change in wheat production has been the shift from durum to hard red spring wheat. According to the South Dakota Crop Reporting Service, hard red spring wheat accounted for about one-third of the total spring wheat production in 1926 compared to over 97 percent in 1950. Only about 0.2 percent of Spink County farmland was in winter wheat in 1950.

Most of the wheat raised is sold on the market. The production of hard red spring wheat is highest on the Harmony, Aberdeen, and Beotia soils of the northern and central part of the Glacial Lake Dakota Plain (Soil Area A, Fig. 3), and on the Beadle and Houdek soils in northeast Spink County.

Spring wheat is usually planted before the middle of April and harvested in July. Harvesting is done by either combining or threshing. The grain is combined standing on some fields where the fields are uniform and have ripened evenly and on other fields it is usually picked up in the swath.

The 1944 South Dakota Crop Reporting Service figures show that corn and oats each comprised about

16 percent of the harvested cropland in the county. An average of 89,000 acres of corn per year was harvested in the 20-year period 1928-47. The low for this period was 1936 when about 26,000 acres were harvested The high year was 1927 when 156,000 acres were harvested. Harvested corn acreages were over 100,000 acres each year from 1924—1932. From 1933 to 1949 they were under 100,000 acres. In 1950, 102,000 acres were harvested. The production of corn is highest on the Hecla and Houdek sandy loams of Soil Area C (Fig. 3), the Houdek and Bonilla loams of the southern part of Soil Area B, and the Beadle and Houdek soils of Soil Area D, and the south half of Soil Area E. In 1950 Spink County ranked eleventh among the counties of South Dakota in acreage of corn harvested and seventeenth in production of corn.

Corn is usually planted before the middle of May and harvested in October or November. Harvesting is done with corn pickers mainly although some is picked by hand. Silage is made from corn in unfavorable climatic years when the crop doesn't mature. Most of the corn is fed on the farms where grown, although some is sold on the market.

The average harvested acreage of oats for the 20-year period 1928-47 was about 50,000 acres according to the South Dakota Crop Reporting Service. The harvested acreage from 1931 to 1940 was below this figure, but it has been generally rising since 1941 and was 91,000 acres in 1950. Oats are raised in the same general area and on the same soils as corn. The oat crop is grown as a nurse crop for legumes and grasses and most of it is fed on the farms where grown. In 1950 Spink County ranked thirteenth among South Dakota counties in acreage of oats harvested and twenty-first in oat production.

Oats are usually planted in April and harvested in July. Harvesting is done by grain binder or by combine.

Average harvested acreage of barley for the 20-year period 1928-47 was 53,200 acres. Since 1924 the acreage devoted to barley has remained fairly steady although it has been declining slightly in recent years. Both malting and feed types of barley are raised with approximately 70 percent of the total being the malting type. The principal barley producing soils in the county are the Beotia, Harmony, and Aberdeen soils of the Glacial Lake Dakota Plain (Soil Area A, Fig. 3). In 1950 Spink County ranked third among South Dakota counties in harvested acreage of barley and seventh in barley production.

The average harvested acreage of rye for the 20-year period 1928-47 was 18,700 acres according to the South Dakota Crop Reporting Service. This is about 4 percent of the cropland in the county. The tendency was for rye production to increase during the 1930's and decrease some since then until 1950 when 37,600 acres were harvested. In 1950 Spink County ranked first among South Dakota counties in acreage of rye harvested and third in rye production.

The average harvested acreage of

alfalfa hay for the 20-year period 1928-47 was 5,800 acres. This is about 0.6 percent of the land in farms in the county. From 1925 to 1932 the average harvested acreage exceeded 10,000 acres; from 1934 through 1947 the average harvested acreage was less than 5,000. It was 6,000 acres in 1947 and 13,300 acres in 1950.

The average harvested acreage of tame hay other than alfalfa (includes sweet clover, millet, Sudan, and grain hay) for the 20-year period 1928-47 was 9,100 acres. This is about 1 percent of the land in farms in the county. The harvested acreage of tame hay was rather high in the 1930's and lower in the 1920's and 1940's.

Average harvested acreage of wild hay for the 20-year period 1928-47 was 41,700 acres. The acreage of wild hay has remained fairly constant but it has increased since 1946.

The acreages of the principal crops and other crops are shown in Table 43 for stated years.

Permanent Pastures

In 1944 the Federal census shows that about 18 percent of Spink County farmland was in pasture. Soil Area B (Fig. 3), the west till plain, has the most pasture with between 20 and 30 percent of the farm land in pasture. This is on the Houdek, Orient, and Crandon soils principally. The Beotia, Harmony and Aberdeen soils of the Glacial Lake Dakota Plain have relatively small pasture percentages, ranging from 7.7 up to about 20. Generally in the southern and southeastern parts of the county, on the Beadle soils, a rather large percentage (usually between 20 and 25 percent) of the farmland is in pasture. Northeast Spink County resembles the Glacial Lake Dakota Plain in having a small percentage of farmland in pasture (about 8 to 15 percent).

The 1944 Federal census shows that only about 4 percent of the pasture is plowable, 1 percent is in woodland, and 95 percent is in other pasture.

Table 43. Harvested Acres of Crops in Spink County for Stated Years*

Crop	1924 Acres	1929 Acres	1934 Acres	1939 Acres	1944 Acres	1949 Acres
Corn	150,600	137,100	45,000	66,000	98,300	86,900
Durum Wheat	----†	229,200	0	12,400	3,000	7,900
Other Spring Wheat	----	96,300	100	166,300	253,300	319,200
Winter Wheat	----	900	0	300	1,600	1,600
Oats	65,000	47,000	0	43,200	95,100	73,600
Barley	44,500	59,000	100	47,600	87,400	39,600
Rye	13,900	8,300	0	18,000	17,400	15,300
Flax	----	5,700	0	270	3,500	11,800
Sorghums for silage	----	----	----	----	14,900	3,750
Sorghums for grain	----	----	----	----	2,000	200
Alfalfa Hay	9,400	14,400	1,900	1,300	1,600	10,300
Other Tame Hay	7,150	4,760	1,120	13,300	2,240	3,570
Wild Hay	59,500	40,300	7,100	30,600	55,500	69,100

*Figures were compiled by South Dakota Crop Reporting Service.
†Data not available.

Table 44. Number of Livestock on Farms in Spink County in Stated Years

Livestock	1924	1934	1944	1951
Cattle	39,000	28,900	46,200	42,900
Hogs	72,000	13,100	67,400	29,600
Sheep and Lambs	11,000	29,100	38,800	15,540
Horses and Mules	21,300	11,600	4,900	1,800
Chickens	------*	168,200	282,300	194,000

*Not available.

Livestock

Raising cattle has been a major enterprise in Spink County for many years. The South Dakota Crop and Livestock Reporting Service lists the average number of cattle for the 20-year period 1928-47 at about 33,000. Numbers decreased in the 1930's until 1938 and there was a gradual increase until 1946 when the record high of 51,000 head of cattle was reached.

Cattle numbers have decreased gradually since 1946 and on January 1, 1951 cattle numbered about 43,000 head. Cattle numbers in 1945 were greatest in western Spink County and in the southern and southeastern parts of the county.

Hogs, like cattle, are not uniformly distributed in the county, and their numbers vary more from year to year. In 1945 hog numbers were greatest in northwest, southwest, and south central Spink County. The average number of hogs for the 20-year period 1928-47 was about 32,000.

The number of sheep and lambs have increased gradually over the period 1924-43. The record high number of 53,500 was reached in 1943 and since then the number has decreased markedly, being 15,400 in 1951. The average number of sheep and lambs for the 20-year period 1928-47 was about 30,700.

The numbers of different kinds of livestock on farms in the county in 1924, 1934, 1944, and 1954, as reported by the Federal census are given in Table 44.

Major Sources of Income

The 1945 Federal census shows that in 1944 cash crops contributed more to farm income in Spink County than did the sale of livestock and livestock products. About 67 percent of farm income in 1944 was from cash crops while 38 percent of the income was from livestock and livestock products. In 1949 cash crops and livestock contributed about equally to farm income. Table 45 shows the value of specified agricultural products in 1944 and 1949.

Table 45. Value of Specified Agricultural Products by Classes in Spink County, in 1944 and 1949

Product	1944	1949
All crops sold	$5,419,491.00	$5,566,398.00
All livestock and livestock products sold	3,645,817.00	5,444,125.00
Dairy products sold	320,109.00	290,361.00
Poultry and poultry products sold	594,746.00	490,054.00
Livestock and livestock products, other than dairy, sold	2,730,962.00	4,663,710.00

Size of Farms

The classification of farms by size, as reported by the Federal census is shown in Table 46.

Table 46. Number of Farms in Various Size Groups in 1945 and 1950

Size of Farms in Acres	Number of Farms 1945	1950
Under 10	17	26
10-29	14	21
30-49	5	14
50-69	6	5
70-99	16	14
100-139	11	12
140-179	100	94
180-219	15	15
220-259	34	43
260-499	686	633
500-999	634	637
1000 and over	122	127

Farm Tenancy

As early as 1890 farm tenancy in Spink County had already reached 20 percent according to the Federal census. Tenancy continued to increase until 1940 when 64.4 percent of the farms were tenant operated. Tenancy has decreased since then, the figures being 41.6 percent in 1945 and 32.6 percent in 1950.

A classification of farms by tenure of operator is given in Table 47.

Table 47. Farms by Tenure of Operator

	April 1, 1950 Farms	January 1, 1945 Farms
All farms	1641	1660
Full owners	414	341
Part owners	686	621
Managers	6	7
All tenants	535	691
Cash tenants	18	11
Share cash tenants	262	172
Share tenants and croppers	231	488
Other and specified tenants	24	20

These census data were compiled by the South Dakota Crop Reporting Service.

Types of Farms

A classification of Spink County farms by type of farm is given in Table 48. These figures are for 1950 and come from the Federal census.

The cash grain farms tend to be located on the Glacial Lake Dakota Plain on the Beotia, Harmony, and Aberdeen soils. The livestock and general farms are located primarily on the Houdek, Bonilla, and Beadle soils surrounding the Glacial Lake Dakota Plain, and on the Hecla and Wessington soils of the sandy plain area.

Table 48. Classification of Farms by Type of Farm

Type of Farm	Number in 1950	Percent in 1950
Cash grain farms	799	48.3
Dairy farms	15	.9
Poultry farms	1	------
Livestock farms other than dairy or poultry	565	34.2
General farms	194	11.8
Primarily crop	5	
Primarily livestock	15	
Crop and livestock	174	
Miscellaneous farms	67	4.8
Total	1641	100.0

Farm Values and Expenditures

The value per farm of land and buildings, as reported by the Federal census in 1950 was $22,250. In 1945 it was $12,300. The average value per acre of farms was $38.16 in 1950 and $22.45 in 1945. The value of land and buildings and value per acre for selected years are

given in Table 49. The average investment per farm can be estimated by adding the prices of implements and livestock to the value of lands and buildings.

The expenditures for Spink County farms in 1950 were as follows: Machinery hired $514,802; hired labor $678,945; feed $636,166; seeds $307,546; gasoline and other petroleum fuel and oil $1,077,371.

Table 49. Value of Land and Buildings in Spink County for Stated Years

Year	Value per farm Dollars	Value per acre Dollars
1910	27,335	56.11
1920	48,319	104.80
1925	26,195	59.88
1930	19,041	41.38
1935	11,020	25.56
1940	7,065	13.69
1945	12,300	22.45
1950	22,250	38.30

CULTURAL GEOGRAPHY OF SPINK COUNTY

THIS SECTION of the report relates to the people of Spink County and their culture. Like the section on agriculture it is intended primarily for people not acquainted with the county. Population, transportation, and marketing facilities, and water supply are discussed.

Organization and Population

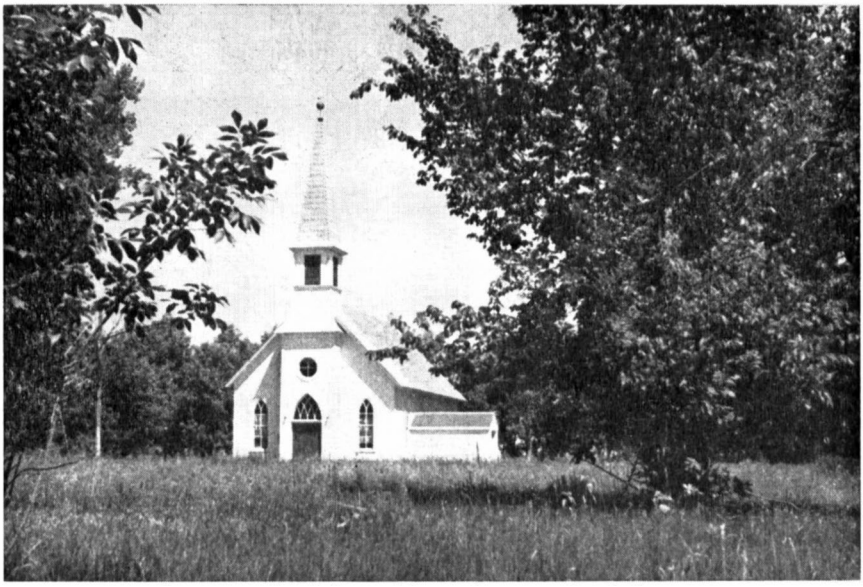
Spink County, which was named in honor of S. L. Spink, an early territorial official, was created in 1873 by the Dakota Territorial Legislature and organized in 1879 with the first county election being held the next year. (3) Ashton was selected as county seat but when it was bypassed by the railroad an election was held in 1884 to select a new county seat location. Although Redfield claimed the victory, voters in the northern part of the county charged that the election returns were fraudulent and the Ashton settlers refused to part with the county records. One night in the fall of 1884, 20 Redfield citizens forcibly moved the records to Redfield. Before the issue was settled the militia from Fargo was ordered to the scene and returned the records to Ashton. After another election in 1886 in which Redfield was again victorious, the records were moved peaceably back to Redfield.

In 1880 the population of Spink County was only 477. Following completion of the railroad in the early 1880's, there was a great influx of settlers mainly from Iowa, Wisconsin, and Minnesota and by 1890 there were over 10,000 residents in the county. There have been gains and losses since that time, but no period matches the decade of 1880-90 for population change.

Table 50 lists the population of Spink County for stated years from Federal and state census figures.

Transportation and Marketing Facilities

Spink County has good transportation and marketing facilities. Three railroad companies provide



A country church located in southwestern Spink County.

service within the county. The Chicago, Milwaukee, St. Paul, and Pacific system has a north-south line going through Mellette, Redfield, and Tulare, and an east-west line going through Doland, Frankfort, and Redfield. The Chicago and Northwestern system has a north-south line going through Northville, Redfield, and Hitchcock. The Minneapolis and St. Louis railway goes through Conde in the extreme northeast part of the county.

In addition to these railroad facilities, the county has a good system of roads. United States Highways 212 and 281 cross the county—the former in an east-west direction through Doland, Frankfort, and Redfield, and the latter in a north-south direction through Redfield and Tulare. In addition several state and county gravel highways and many graded gravel roads provide outlets for a large proportion of the farms.

Table 50. Total Rural and Urban Populations in Spink County for Stated Years

Year	Total Population	Rural Number	Rural Percent	Urban* Number	Urban* Percent
1880	477	----------	------	--------	------
1890	10,581	----------	------	--------	------
1900	9,487	8,472	89.3	1,015	10.7
1910	15,981	13,125	82.1	2,856	17.9
1930	15,304	12,640	82.6	2,664	17.4
1950†	12,204	9,549	78.2	2,655	21.8

*Redfield only.
†Preliminary 1950 census.

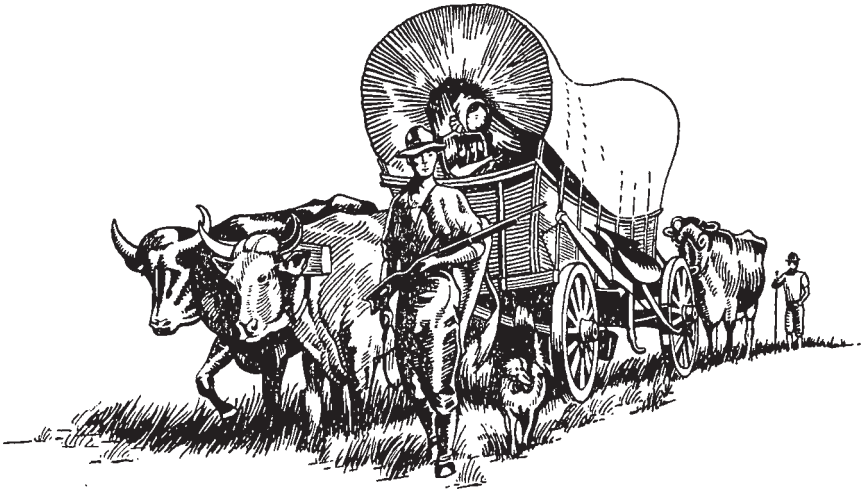
Top: Cottonwood Lake, located about 12 miles southwest of Redfield, furnishes recreation for the region. *Bottom:* A pool below a James River dam which usually affords good fishing. This small dam is in southern Spink County. The soil on the terrace is La Delle silt loam.

The Federal census data for 1950 show that the average farmer is 8 miles from a trading center. A breakdown of the average shows that about 29 percent of the farms are 10 or more miles from a trading center, about 39 percent are between 5 and 9 miles, about 25 percent are between 1 and 4 miles, and about 7 percent are less than 1 mile from a trading center.

Water Supply

Artesian wells sunk into the Dakota sandstone provide most of the water needed for human and livestock consumption in Spink County. Shallow wells sunk into the sand and gravel deposits of Soil Area C (Fig. 3) supply part of the water requirements in this area of the county. In 1935, according to the South Dakota State Planning Board, there were 1,877 deep artesian wells distributed rather uniformly in the county. Although generally satisfactory for human and livestock consumption, artesian water is not suitable for irrigation purposes due to the high concentration of soluble salts present in the water.

Cottonwood Lake and Twin Lakes are natural bodies of water used for recreational purposes. Redfield Lake, an artificial lake, also furnishes recreational facilities. Fishing is also afforded by the larger streams.



GLOSSARY

Alkali soil—A soil that contains sufficient exchangeable sodium to interfere with the growth of most crop plants, either with or without appreciable amounts of soluble salts.

Alluvium—Fine material, as sand, mud, or other sediments deposited on land by streams.

Basin listing—A method of tillage which creates small basins by damming lister furrows at regular intervals of approximately 4 to 20 feet. This facilitates retention, penetration, and uniform distribution of moisture and retards erosion on sloping lands.

Calcareous soil—Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly to the naked eye when treated with hydrochloric acid. Soil alkaline in reaction, owing to the presence of free calcium carbonate.

Chisel—Any machine carrying one or more soil-penetrating points, with sufficient weight to force the points into the soil to a depth of 12 to 18 inches, so that they may be drawn along at that depth to loosen the subsoil.

Clay—The small mineral soil grains, less than 0.002 mm. (.000079 inch) in diameter.

Claypan—A dense and heavy soil horizon underlying the upper part of the soil; hard when dry and plastic or sticky when wet.

Colluvium—Deposits of soil material accumulated at the base of slopes through the combined influences of water and gravity.

Complex—A soil association mapped as a unit because it is composed of two or more soil series, types, or phases occurring together in such an intricate pattern or in such small individual areas that they cannot be shown separately on maps of the scale used, as Houdek-Bonilla loams and Hecla-Letcher sandy loams.

Consistence—The degree of firmness of soil aggregates or of entire soil horizons due to the attraction of particles for one another and expressed in terms of resistance of soil to crushing, as loose; slightly, moderately or very compact; friable; crumbly; plastic; soft; firm; hard; and cemented.

Cropland—Land regularly used for crops, except forest crops. It includes rotation pasture, cultivated summer fallow, or other land ordinarily used for crops but temporarily idle.

Fertility—The quality that enables a soil to provide the proper compounds, in the proper quantities and in the proper balance, for the growth of specified plants when other factors, as light, temperature, moisture, and the physical condition of the soil, are favorable.

Friable—Easily crumbled in the fingers; nonplastic.

Genesis—Mode of origin of the soil, referring particularly to the processes responsible for the development of the solum from unconsolidated parent materials.

Glacial Till—Rock and earth materials that have been transported through the action of ice (glaciers). Glacial till is unsorted, that is the clay, silt, sand, and boulders are all mixed together.

Granular—Soil consisting of roughly spherical aggregates, either hard or soft. Present in the A horizons, especially the A_1 horizons.

Green-Manure crop—Any crop grown and plowed under for the purpose of improving soil, especially by the addition of organic matter.

Horizon—A layer of soil approximately parallel to the land surface, with relatively well defined characteristics that have been produced through the operation of soil-building processes.

Humus—The well-decomposed, or more or less stable part of the organic matter of the soil.

Lacustrine deposits—Materials deposited by lake waters.

Leaching—Removal of materials in solution.

Loam soil—Soil having approximately equal amounts present of sand, silt, and clay.

Loess—A fine textured, usually silty, deposit laid down by wind.

Massive—Characterized by large uniform masses of cohesive soil, sometimes with ill-defined and irregular breakage.

Nutrients, plant—The elements that may be taken in by the plant, essential to its growth. These include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps others obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from air and water.

Parent material—The unconsolidated mass from which the soil profile develops.

Permeability—Readiness with which the soil transmits water.

pH.—A term to indicate weak acidity and alkalinity, as those existing in soils. A pH of 7.0 indicates precise neutrality; large numbers (up to 14.0), alkalinity; and smaller ones (down to 0.0) acidity.

Phase—A subdivision of soil type differing appreciably in such characteristics as relief, accelerated erosion, or stoniness. Phase variations have practical importance, although it may or may not be reflected in profile characteristics.

Platy—Having thin, horizontal plates, usually not well-defined, as in the A_2 horizon of Exline silty clay loam.

Prismatic structure—Blocky structure with the vertical axis of the blocks longer than the horizontal, as in the B horizon of Houdek loam.

Productivity—The capability of a soil to produce a specified plant or sequence of plants under a specified system of management.

Profile, soil—A vertical section of the soil through all its horizons and extending into the parent material.

Saline soil—A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The percent of soluble salts is usually in excess of 0.15 percent.

Saline-Alkali soil—A soil containing sufficient exchangeable sodium to interfere with the growth of most crop plants, and containing appreciable amounts of soluble salts. The exchangeable-sodium percentage is greater than 15 and the percent of soluble salts is usually in excess of 0.15 percent.

Sand—Small rock or mineral fragments with diameters ranging between 0.05 mm. (0.002 inches) and 1.0 mm. (0.039 inches). The term sand is also applied to soils containing 90 percent or more of sand.

Series—A group of soils having genetic horizons similar as to differentiating characteristics and arrangement in the soil profile, except for the texture of the surface soil, and developed from a particular type of parent material. A series may include two or more soil types differing from one another in the texture of the surface soil.

Silt—Small mineral soil grains ranging from 0.05 mm. (0.002 inches) to 0.002 mm. (0.000079 inches) in diameter.

Soil—A natural body on the surface of the earth in which plants grow; composed of organic and mineral materials.

Soil class—A classification based on the relative proportion of soil separates. The principal classes, in increasing order of the content of the finer separates, are as follows: sand, loamy sand, sandy loam, loam, silt loam, silty clay loam, clay loam, and clay.

Soil separates—The individual size groups of soil particles, as sand, silt, and clay.

Solum—The upper part of the profile above the parent material. In mature soils this includes the A and B horizons (surface soil and subsoil).

Structure—The aggregates in which the individual soils particles are arranged. (The principal types of structure in the soils of this county are granular, massive, platy, single grain, blocky, and prismatic.)

Subsoil—That part of the soil profile commonly below plow depth and above the parent material.

Texture—The relative proportion of the various size groups of individual soil grains.

Till, glacial—See Glacial Till.

Tilth—The physical condition of a soil in respect to its fitness for the growth of a specified plant.

Topography—The elevations or inequalities of the land surface.

Type—A group of soils having similar genetic horizons and characteristics, including texture and arrangement in the soil profile, and developed from a particular kind of parent material.

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B411 Jerauld County, 1951

B421 Day County, 1952

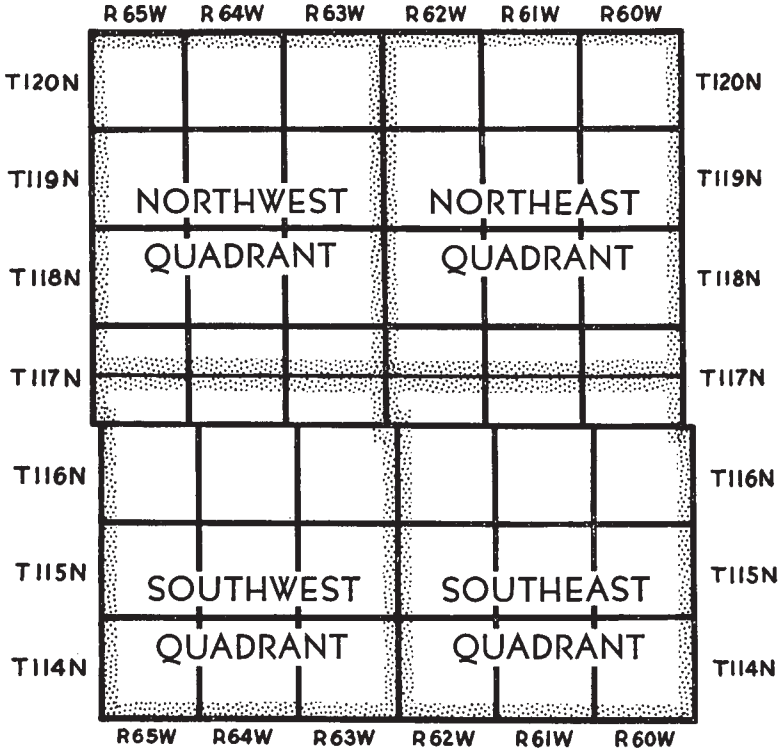
B430 Clay County, 1953

C88 Soils of South Dakota, 1951

LEGEND

FOR SOIL SURVEY MAP OF SPINK COUNTY SOUTH DAKOTA

BULLETIN 439



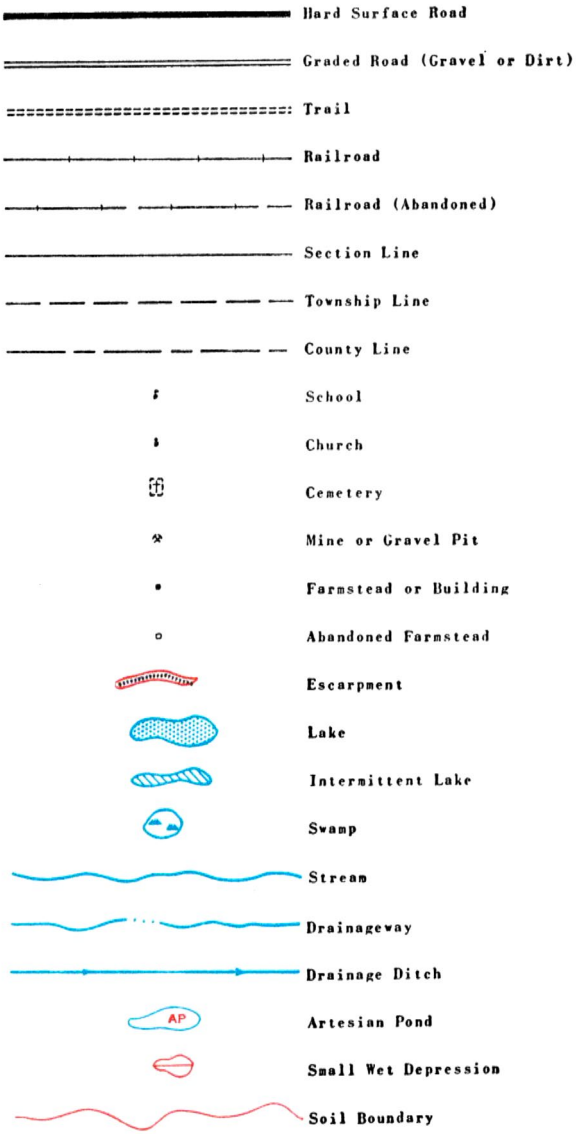
NOTE—Soil numbers and lines are in RED; drainage is in BLUE; and section lines, roads and other cultural features are in BLACK.

Agronomy Department
AGRICULTURAL EXPERIMENT STATION
South Dakota State College
In Cooperation With
Soil Conservation Service, U.S.D.A.

Map Number (in red)	Soil Type	For Soil Description See Bull. Page	For Yield Predictions See Bull. Page
1.	Aberdeen silty clay loam, level (0-1%)	22	114
2.	Aberdeen silty clay loam, nearly level (2-3%)	22	114
3.	Aberdeen silty clay loam, till substratum, level (0-1%)	23	114
4.	Aberdeen loam, level (0-1%)	23	114
5.	Aberdeen-Harmony silty clay loams, level (0-1%)	23	114
6.	Beadle silt loam, nearly level (0-2%)	24	113
7.	Beadle silt loam, stony, nearly level (0-2%)	25	113
8.	Beadle silt loam, nonsaline substratum, nearly level (0-2%)	26	113
9.	Beadle silt loam, stony, nonsaline substratum, nearly level (0-2%)	26	113
10.	Beadle silt loam, undulating (3-5%)	27	118
11.	Beadle silt loam, nonsaline substratum, undulating (3-5%)	27	118
12.	Beadle-Cavour silt loams, nearly level (0-2%)	27	114
13.	Beadle-Cresbard silt loams, nearly level (0-2%)	28	113
14.	Beadle-Houdek-Cresbard silt loams, nearly level (0-2%)	29	113
15.	Beotia silt loam, level (0-1%)	29	113
16.	Beotia silt loam, moderately saline substratum, level (0-1%)	30	113
17.	Beotia silt loam, till substratum, level (0-1%)	31	113
18.	Beotia silt loam, nearly level (2-3%)	31	113
19.	Beotia silt loam, moderately saline substratum, nearly level (2-3%)	31	113
20.	Beotia silt loam, till substratum, nearly level (2-3%)	32	113
21.	Beotia silt loam, gently sloping (4-5%)	32	116
22.	Beotia silt loam, valley phase, nearly level (0-2%)	32	113
23.	Bonilla-Houdek loams, nearly level (0-2%)	33	113
24.	Bonilla-Houdek silt loams, nearly level (0-2%)	34	113
25.	Bonilla-Cresbard silt loams, nearly level (0-2%)	34	113
26.	Bonilla-Houdek fine sandy loams, nearly level (0-2%)	35	112
27.	Bonilla-Houdek fine sandy loams, firm till substratum, nearly level (0-2%)	35	112
28.	Bonilla-Groveland fine sandy loams, nearly level (0-2%)	36	112
29.	Cavour-Beadle silt loams, nearly level (0-2%)	37	114
30.	Cavour-Houdek loams, nearly level (0-2%)	38	114
31.	Cavour thin surface-Tetonka complex, nearly level (0-2%)	38	115
32.	Crandon-Houdek loams, hilly (10-15%)	39	119
33.	Cresbard-Beadle silt loams, nearly level (0-2%)	40	113
34.	Cresbard-Bonilla silt loams, nearly level (0-2%)	41	113
35.	Doland silt loam, nearly level (0-2%)	41	113
36.	Doland silt loam, loamy fine sandy substratum, gently sloping (3-5%)	42	113
37.	Doland silt loam-Solonetz complex, nearly level (0-2%)	42	113
38.	Eckman loam, nearly level (2-3%)	43	113
39.	Eckman loam, level (0-1%)	44	113
40.	Eckman loam, gently sloping (4-5%)	44	116
41.	Eckman loam, sloping (6-9%)	44	116
42.	Eckman loam, valley phase, nearly level (0-2%)	45	113
43.	Eckman fine sandy loam, nearly level (0-2%)	45	112
44.	Exline complex, level (0-1%)	46	115
45.	Exline complex, nearly level (2-3%)	47	115
46.	Great Bend silt loam, gently sloping (4-5%)	47	116
47.	Great Bend silt loam, nearly level (2-3%)	48	113
48.	Great Bend silt loam, level (0-1%)	48	113
49.	Great Bend silt loam, sloping (6-9%)	49	116
50.	Great Bend silt loam, till substratum, nearly level (2-3%)	49	113
51.	Great Bend silt loam, till substratum, gently sloping (4-5%)	50	116
52.	Great Bend-Zell silt loams, nearly level (0-3%)	50	115
53.	Hamerly loam, nearly level (0-2%)	51	115
54.	Hand-Houdek loams, gently undulating (1-3%)	52	113
55.	Harmony silty clay loam, level (0-1%)	53	113
56.	Harmony silty clay loam, nearly level (2-3%)	54	113

Map Number (in red)	Soil Type	For Soil Description See Bull. Page	For Yield Predictions See Bull. Page
57.	Harmony silty clay loam, till substratum, level (0-1%)	54	113
58.	Harmony loam, level (0-1%)	54	113
59.	Hecla sandy loam, nearly level (0-2%)	55	112
60.	Hecla sandy loam, till substratum, nearly level (0-2%)	56	112
61.	Hecla loamy fine sand, nearly level (0-2%)	56	112
62.	Hecla loamy fine sand, till substratum, nearly level (0-2%)	56	112
63.	Hecla-Hamar loamy fine sands, nearly level (0-2%)	57	112
64.	Hecla-Hamar loamy fine sands, wind eroded, hummocky (0-2%)	57	112
65.	Hecla-Letcher loamy fine sands, nearly level (0-2%)	58	114
66.	Hecla-Letcher sandy loams, nearly level (0-2%)	59	114
67.	Houdek-Bonilla loams and silt loams, undulating (3-5%)	59	118
68.	Houdek-Bonilla loams and silt loams, stony undulating (3-5%)	60	118
69.	Houdek-Bonilla silt loams, undulating (3-5%)	61	118
70.	Houdek-Bonilla silt loams, stony, undulating (3-5%)	61	118
71.	Houdek loam-Crandon gravelly loam, undulating (3-5%)	61	118
72.	Houdek silt loam, firm till substratum, undulating (3-5%)	62	118
73.	Houdek-Cavour loams and silt loams, gently undulating (2-3%)	62	118
74.	Houdek-Bonilla fine sandy loams, undulating (3-5%)	62	117
75.	Houdek-Groveland fine sandy loams, undulating (3-5%)	63	117
76.	Houdek fine sandy loam, thin solum, undulating (3-7%)	63	117
77.	Houdek loam, thin solum, undulating (3-5%)	64	118
78.	Houdek loam, rolling (6-9%)	64	119
79.	Houdek silt loam, rolling (6-9%)	64	119
80.	Houdek loam, thin solum, rolling (6-9%)	65	119
81.	Houdek silt loam, firm till substratum, rolling (6-9%)	65	119
82.	Houdek loam-Crandon gravelly loam, rolling (6-9%)	65	119
83.	Houdek loam, very stony, rolling (6-9%)	66	119
84.	Houdek-Orient loams, hilly (10-30%)	66	119
85.	Houdek-Orient loams, very stony, hilly (10-30%)	67	119
86.	La Delle silt loam, level (0-1%)	67	113
87.	La Delle silt loam, nearly level (2-3%)	69	113
88.	La Delle silty clay loam, level (0-1%)	69	113
89.	La Delle-Lamoure silt loams, nearly level (0-2%)	69	119
90.	La Delle-Northville silty clay loams, level (0-1%)	70	113
91.	La Delle-Northville silt loams, level (0-1%)	71	113
92.	Lamoure silty clay loam	71	120
93.	Lamoure silty clay loam, saline	72	120
94.	La Prairie-Tetonka silt loams, nearly level (0-2%)	72	119
95.	Maddock sandy loam, undulating (3-5%)	73	112
96.	Maddock loamy fine sand, till substratum, undulating (3-5%)	74	112
97.	Maddock-Hamar loamy fine sand, wind eroded, hummocky (3-5%)	74	112
98.	Maple silty clay loam	75	120
99.	Orient-Crandon complex, stony, hilly (10-30%)	76	119
100.	Rauville silty clay loam	78	None given
101.	Spottswood loam, nearly level (0-2%)	78	116
102.	Tanberg loamy fine sand	79	120
103.	Tetonka silt loam	80	119
104.	Tetonka silt loam, poorly drained	81	120
105.	Twin Lakes-Wessington loams, nearly level (0-2%)	81	116
106.	Twin Lakes-Wessington loams, undulating (3-5%)	83	116
107.	Wessington loam, nearly level (0-2%)	83	116
108.	Wessington loam and sandy loam, nearly level (0-2%)	84	116
109.	Wessington loam and sandy loam, undulating (3-5%)	84	116
110.	Zell-Great Bend silt loams, gently sloping (4-5%)	84	117
111.	Zell-Great Bend silt loams, eroded, sloping (6-9%)	85	117
112.	Zell-Great Bend silt loams, eroded, steep (10-30%)	86	119

CONVENTIONAL SIGNS



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